**REPLACING PAGE ADDENDUM**
***Filing Instructions:***
1. REMOVE FROM THE SECTION THE PAGES NUMBERED THE SAME AS THOSE ATTACHED TO THIS PINK SHEET.
2. INSERT THE ATTACHED PAGES INTO THE SECTION IN THEIR PLACE.
3. PLACE THIS PINK SHEET AHEAD OF PAGE 1 OF THE SECTION.



# DETACHED-CONTACT-TYPE SCHEMATIC DRAWINGS (SDs) DESCRIPTIVE INFORMATION

## 1. GENERAL

**1.001** This addendum supplements Section 005-109-101, Issue 2. The attached pages must be inserted in the section in accordance with the filing instructions above.

**1.002** This addendum is issued to reflect the latest standards in the representation of keys and to correct a printing error.

## 5. APPARATUS FIGURES

The following changes apply to Part 5 of the section:

(a) 5.08(b) — Corrected to make lines read in proper sequence.

(b) 5.26(b) — "Clockwise" requirement removed.

(c) 5.27 — Revised to exclude pushbutton keys from keytop requirements and to indicate latest key orientation practices.

(d) Fig. 9, page 28 — revised.

**Attached:**

**Page 9 dated October 1966, revised.**
**Page 10 dated October 1966, revised.**
**Page 11 dated October 1966, revised.**
**Page 12 dated October 1966, revised.**
**Page 12.1 dated October 1966, added.**
**Page 28 dated October 1966, revised.**

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# DETACHED-CONTACT-TYPE SCHEMATIC DRAWINGS (SDs)
# DESCRIPTIVE INFORMATION

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## 1. GENERAL

**1.01** This section describes a type of circuit drawing being issued by the Bell Telephone Laboratories, Incorporated, in the SD drawing series. The drawings are called detached-contact schematics. The manner of presenting the circuit information, the symbols and conventions employed, and other facts concerning detached-contact schematics are covered in this section.

**1.02** This section is reissued in order to bring the information it contains into agreement with the latest practices. This involves changes and additions to the text and illustrations. Since this is a general revision, the arrows ordinarily used to indicate changes are omitted. Detailed information concerning the changes will be found under Reasons for Reissue at the end of this section.

**1.03** An SD drawing contains the ***basic*** circuit information for a specific part of a switching system. An entire switching system may be represented by a group of SDs. These drawings provide, in one compact whole, information needed for:

(a) Manufacture and shop testing.

(b) Installation and testing prior to cutover.

(c) Training of personnel in the understanding of the circuit.

(d) Engineering of switching systems.

(e) Operation and maintenance of the circuit.

**1.04** Since about 1928, SD drawings have been prepared in what may be called "attached" form. That is, the individual relays, jacks, keys, coils, tubes, etc, which, when properly wired together, constitute a circuit, were shown in the SD as complete physical units. Because many of these apparatus items consisted of separate parts (contacts) that were used to perform multiple functions in the circuit, it was necessary to show the circuit paths going back and forth between the separate parts of the apparatus items. This method of presenting the circuit was generally satisfactory for the types of circuits then in use. However, with the gradual replacement of manual switching systems by more and more complex dial switching systems, it became increasingly difficult to present the circuit information in SD drawings in a manner suitable for the many uses made of the information. Sometimes, it was difficult to understand the circuit, and the tracing of circuit paths was complicated by having to follow the action of the circuit through a large number of paralleling and crossing lines that frequently extended over a number of sheets of the drawing. In recent years, with the introduction of common control switching systems and automatic message accounting, it became imperative that a different method of presenting switching systems circuits be devised. Some of the complex circuits of these newer systems are comprised of thousands of individual relays, tubes, and other apparatus items. Under such conditions, the presentation, understanding, and use of the circuit information involved numerous difficulties. As a result of extensive investigation of various arrangements for presenting switching systems circuit information in a simplified and more generally satisfactory manner, the detached-contact-type SD described in this section has been devised. Indications are that these methods of presenting circuit information are well suited for large complicated circuits as well as for smaller, simpler circuits. It is intended, therefore, that the detached-contact-type of drawing will be used for all new systems and for major new circuits added to existing systems. In addition, it will be used for major changes in existing switching systems circuits.

**1.05** The information contained in a detached-contact-type schematic drawing is separated into class groups, each serving to portray information of a similar character. Cross referencing between the groups is employed to coordinate the information. Extensive indexes located on the first page or pages of the drawings help to locate individual items of information in any

group of the drawings. Each of these groups that has been established is described in individual detail in this section.

**1.06** In a detached-contact-type SD drawing, the circuit paths are presented in a manner that emphasizes the functions performed by the circuit. The circuit paths are shown in a series of Functional Schematics (FSs) constituting one of the groups of the drawing. Each FS represents a function or a related group of functions and shows the complete functioning paths of all relays and other apparatus involved. An attempt is made to show all circuit paths complete from battery to ground, even though this may require repeating information shown in other FSs or other circuits. External circuit information, however, is not necessarily shown in complete detail, but only sufficiently to give meaning to the function path.

**1.07** In order to achieve the objectives of an FS, relays, jacks, keys, switches, and other apparatus having parts that perform separate operations are shown in a "detached" manner whenever this is helpful. For example, relay contacts are shown directly associated with the functional path of which they are a part and not in their physical relation to the relay coil that operates them. In this sense, therefore, the relay contacts are "detached" from their operating coil. Thus, detached-contact schematics are fundamentally different from attached-contact-type schematics which emphasized physical apparatus grouping.

**1.08** In switching systems circuits, the individual parts of a given relay, jack, key, or other switching component in a circuit may perform different functions. As a result, the individual parts may be shown in numerous FSs of the circuit. This condition requires that a means be provided for readily associating the detached parts into their physical relation to each other. This is done by showing all of the parts of each piece of apparatus in "attached" form in another group of the drawing called Apparatus Figures (APP FIGs). In addition to showing each apparatus item in its physical arrangement, APP FIGs serve as an index of where all of the parts of each piece of apparatus are shown on the FSs of the circuit. Also, the APP FIG. gives the code number of each apparatus item as well as the quantity required. When the apparatus item is available in a variety of values, the particular value required is given. An APP FIG., therefore, indicates complete information for ordering all of the individual apparatus items that are included in a coded apparatus unit (J code).

**1.09** As an aid to understanding the circuit, another group of information known as Sequence Charts (SCs) is usually included as part of the drawing. These SCs show the time order (sequence) of operation and release of the relays, switches, and other electromagnetic and electronic devices as they perform their various functions in the circuit.

**1.10** In addition to the three groups of circuit information (FSs, APP FIGs., and SCs) described briefly above, other information required to complete the circuit story is contained in other groups of the drawing. However, since they are all auxiliary to the above three fundamental groups of circuit information, these other groups will be discussed in detail later in this section.

**1.11** The figures referred to in the following text are to be found at the end of the section. The configurations, charts, tables, indexes, etc, illustrated in these figures are typical and do not represent a particular systems drawing.

## 2. ARRANGEMENT OF INFORMATION IN THE DRAWINGS

### A. General

**2.01** Reference is made in this section to sectionalized and nonsectionalized drawings Drawings that contain three or more sheets of FSs, or drawings covering circuits comprised of approximately 30 or more relays having different functional designations are usually sectionalized. Drawings that do not meet one or the other of the above conditions are usually classed as nonsectionalized.

**2.02** All sheets of both sectionalized and nonsectionalized SDs of the detached-contact type are drafted on tracing forms measuring 22 by 34 inches; when printed for field use, all sheets are reduced to 11 by 17 inches.

**2.03** The drawing number, sheet number, complete title, and rating are shown in the lower right-hand corner of the first sheet of each drawing. All subsequent sheets show the drawing, sheet number, and an abbreviated title. The

system of numbering the sheets and the arrangement of the circuit information differs for sectionalized and nonsectionalized drawings. These differences are explained below in B and C.

**2.04** As will be noted from the following text, the circuit information for both sectionalized and nonsectionalized drawings is given in clearly separated groups. For this reason, when drawings are reissued to add information it will be possible, in most instances, to place the added information with existing similar information without disturbing the sheet numbers of the drawing.

**2.05** Occasionally the statement SEE NOTE, followed by the numbers 1, 2, etc, is shown on a sheet of the drawing. These are references to sheet notes located somewhere on the sheet. These notes are numbered in sequence starting with note 1 on each sheet, and they are used to clarify the information on the sheet where the SEE NOTE statement is shown.

### B. Sectionalized Drawings

**2.06** Sectionalized drawings are arranged in clearly separated groups for each type of circuit information. Each group is assigned a letter designation from A to G, as shown in Table A. The sheets in each group are numbered in sequence. The group letter and sheet number are shown on each sheet as part of the last suffix in the drawing number. For example, on SD-27000-01-A2, the A2 indicates Group A, Sheet 2.

**Table A — Arrangement of Information in Sectionalized Drawings**

| GROUP | CONTENTS |
|---|---|
| A | Sheet Index<br>Supporting Information<br>Apparatus Index<br>Lead Index<br>Option Index |
| B | Functional Schematics (FS) |
| C | Apparatus Figures (APP FIG.) |
| D | Circuit Notes (100 Series)<br>Equipment Notes (200 Series)<br>Information Notes (300 Series) (Block Diagrams, Theory Schematics)<br>Cross-connecting Information and Notes (400 Series)<br>Transmission Test Requirements Table<br>Working Limits |
| E | Sequence Charts (SC) |
| F | Circuit Requirements Tables (CRT)<br>Timing Requirements Tables (TRT) |
| G | Cabling Diagrams (CAD) |

**2.07** Each type of information listed above is described in this section. Some circuits may not contain information in one or another of the groups; in such cases, the group letter is not used. For example, if SCs are not furnished with issue 1 of a drawing, the E group is omitted.

**2.08** To facilitate locating the information in the SD, sheet coordinates are furnished on most sheets. Only sheets in the A group and the F group do not have sheet coordinates since they would serve no useful purpose on sheets of these groups. Two systems of coordinates are used, as follows:

(a) On sheets in the B, C, D, and G groups, the numbers 0 to 9, evenly spaced, are placed from left to right on the top and bottom edges of the sheet. The letters A to H, evenly spaced, are placed from top to bottom at the left- and right-hand edges of the sheet.

(b) On sheets in the E group (which contain the Sequence Charts) numbers starting with 1, evenly spaced, are placed from top to bottom on the left- and right-hand edges of the sheet. Letters starting with A, evenly spaced, are placed from left to right at the top and bottom edges of the sheet.

**2.09** Coordinate location information consists of three parts, the sheet number, a letter coordinate, and a number coordinate. Except where FS (B group) coordinate locations are referred to in APP FIGs (C group), coordinates are not usually cross-referenced from one group of sheets to another group. Therefore, the group identification is omitted from the coordinate. A coordinate such as 7H5 referred to in the FS sheets (B group) means sheet B7, letter coordinate H, and number coordinate 5. Coordinate 3AA10 referred to in the SC sheets (E group) means sheet E3, letter coordinate AA, and number coordinate 10.

### C. Nonsectionalized Drawings

**2.10** In nonsectionalized drawings, the information is arranged as follows:

(a) All sheets are numbered in sequence starting with sheet 1. The last sheet number is shown on each sheet as the last suffix in the drawing number. For example, on SD-26085-01-3, the digit 3 indicates sheet 3.

(b) An Apparatus Index is not ordinarily furnished, but if it is, no equipment location is shown, since for small circuits the apparatus is usually concentrated in a small area on a single equipment unit or central office frame.

(c) The circuit notes and other information (assigned to the D group in sectionalized drawings) are located on the first sheet and second sheet, if necessary.

(d) If space permits, the APP FIG. is placed on the same sheet as the FS.

(e) SCs are generally located on a separate sheet, but if there is sufficient space they may be located on the same sheet with the FS to which they apply. Circuits with only a few operating elements may not require an SC.

(f) If space permits, CADs are placed on the same sheet with the Circuit Requirements Table.

**2.11** The system of coordinates, as described in 2.08 for sectionalized drawings, is also used on nonsectionalized drawings.

**2.12** On reissues of nonsectionalized drawings, if a new sheet is added it usually is placed at the end of the drawing, but it may be placed within the existing sheet structure by reassigning the page numbers of the drawing.

**2.13** Based on the above, the arrangement of a typical nonsectionalized drawing is as shown in Table B.

**Table B — Arrangement of Information in Nonsectionalized Drawings**

| SHEET | CONTENTS |
|---|---|
| Sheet 1 (and Sheet 2, if required) | Sheet Index<br>Supporting Information<br>Apparatus Index (if furnished)<br>Lead Index (if furnished)<br>Option Index<br>Transmission Test Requirements Tables<br>Working Limits |
| | Circuit Notes (100 series)<br>Equipment Notes (200 series)<br>Information Notes (300 series)<br>(Block Diagrams, Theory Schematics)<br>Cross-connection Information and Notes (400 series) |
| Subsequent Sheets | Functional Schematics (FS)<br>Apparatus Figures (APP FIG.)<br>Sequence Charts (SC)<br>Circuit Requirements Tables (CRT)<br>Timing Requirements Tables (TRT)<br>Cabling Diagrams (CAD) |

## 3. INDEXES AND SUPPORTING INFORMATION

### A. Sheet Indexes

**3.01** The Sheet Index gives the contents of each sheet of the drawing. It is always placed in the upper left-hand part of sheet 1 of nonsectionalized drawings. On sectionalized drawings, it is placed on sheet A1 and may extend to sheets A2, A3, etc.

**3.02** ***Sectionalized Drawings:*** Fig. 1 shows a Sheet Index for a sectionalized drawing. The column designated CONTENTS lists the subject or title of the circuit information shown on each sheet. The column designated SHEET NO. lists the sheet numbers in sequence; namely A1, A2, A3, B1, B2, B3, etc. The remaining columns with the over-all designation of ISSUE NO. show the latest issue of each sheet.

**3.03** ***Nonsectionalized Drawings:*** Fig. 2 and 3 show a Sheet Index for a nonsectionalized drawing. Fig. 2 illustrates a Sheet Index for a nonsectionalized drawing that is arranged to be reissued on an individual sheet basis. This type of Sheet Index is the same as for sectionalized drawings except that the sheet numbers are listed as 1, 2, 3, 4, etc. Fig. 3 illustrates a Sheet Index for a nonsectionalized drawing that is not arranged to be reissued on an individual sheet basis. In this type of Sheet Index, the first column, designated SHEET NO., lists the sheet numbers in sequence; namely 1, 2, 3, etc. The second column, designated CONTENTS, lists the subject or title of the circuit information shown on each sheet.

### B. Supporting Information

**3.04** The Supporting Information Table (see Fig. 4) shows the Equipment Drawings (J or ED) and Equipment Design Requirements Specifications (J Specs) for the circuit. If there are any other specifications covering Supporting Information, such as Trunk Tables, they also are shown. The Supporting Information is always located in the upper right-hand part of sheet A1 on sectionalized drawings and sheet 1 on non-sectionalized drawings.

### C. Apparatus Index

**3.05** The Apparatus Index, when provided, contains information for locating all apparatus in the FSs and APP FIGs. (excepting networks as explained in 3.07). For some circuits, the Apparatus Index also shows the equipment location of the apparatus.

**3.06** As shown in Fig. 5, the Apparatus Index is divided into four columns, arranged as follows:

(a) The DESIG column lists the apparatus designations. Relays are listed first, followed by other types of apparatus in alphabetical order of their type. For example, relays, capacitors, cords, jacks, keys, lamps, etc. The apparatus type is shown horizontally above the associated information. For each type of apparatus, numbered functional designations are listed first in numerical order, and are followed by lettered functional designations in alphabetical order.

(b) Under the heading LOCATION, the FS column lists the FS sheet number and location coordinates of the apparatus. The location coordinates for relays refers to the location of the relay coils. Note that the sheet group designation (B) is omitted, since it is understood that on sectionalized circuits FSs are always located in the (B) group.

(c) Under the heading LOCATION, the APP FIG. column lists the APP FIG. number of which the apparatus is a part. Where an APP FIG. extends over several sheets of the drawing and the apparatus is not arranged alphabetically within the APP FIG., the APP FIG. sheet number where the apparatus is located is shown in addition to the APP FIG. number. The APP FIG. number is shown first, followed by the sheet number; that is, 18 (C7).

(d) The EQPT column is always provided, but is used only when it is desired to show where the apparatus is located on the frame, bay, plate, etc. This is usually necessary only when the apparatus is spread over eight or ten mounting plates or over more than one equipment bay. The bay number is shown first, followed by the plate number; that is, 1-10. It may also be necessary to show the apparatus location when the apparatus is mounted in a cabinet or on a panel. In these cases, the cabinet or panel name is shown.

**3.07** Contact protection networks are not usually included in the Apparatus Index since they are usually connected to and given the same designation as the apparatus whose energy is to be absorbed. However, they are included in the Apparatus Index where they are used for purposes other than contact protection or where they are not directly associated with a particular piece of apparatus. Contact protection networks are listed in the APP FIG. and the exact FS location is given there.

### D. Lead Index

**3.08** The Lead Index gives the location on the FS and on the CAD sheet, where necessary, of all the leads that connect to other circuits.

**3.09** As shown in Fig. 6, the Lead Index is arranged as follows:

(a) The connecting circuit title is shown horizontally above the associated group of leads. The circuit titles are usually listed alphabetically.

(b) The DESIG column lists the designations of leads (or groups of leads) to the connecting circuit. Number designations are listed first in numerical order, and are followed by letter designations in alphabetical order.

(c) The FS LOC column lists the FS sheet number and location coordinates where the leads are shown. When a group of leads is spread over several consecutive coordinates, only the coordinates for the center of the group are given.

(d) The CAD LOC column lists the CAD sheet number and location coordinates where the leads are shown. When a group of leads is spread over several consecutive coor-

dinates, only the coordinates for the center of the group are given. Where CAD information is shown on a sheet that does not have location coordinates, the number of the CAD that contains the leads is listed.

### E. Option Index

**3.10** The Option Index gives the location on the drawing of all optional APP FIGs., optional apparatus, and optional wiring. The Option Index (see Fig. 7) is arranged as follows:

(a) The APP OR WIRING column lists the designations of optional APP FIGs., optional apparatus, and optional wiring. Number designated APP FIGs. are listed first in numerical order followed by letter designated APP FIGs., if any, in alphabetical order and then by single letter designations in reverse alphabetical order. Additional designations ZA, ZB, ZC, etc, are listed, if required.

(b) The LOCATION column shows:

(1) For optional APP FIGs., the APP FIG. designation and, in addition, where necessary, the FS sheet number and location coordinates of wiring not covered in the APP FIG. See Fig. 7 (first five entries).

(2) For optional apparatus and wiring, the APP FIG. number of which the apparatus is a part and, in addition, the FS sheet number and location coordinates of the option not covered in the APP FIG. See Fig. 7 (Y, X, and T entries).

(3) For optional wiring only, the FS sheet number and location coordinates. See Fig. 7 (Z, W, V, S, and Q entries). Where a wiring option appears only in a cabling diagram (CAD), the CAD number in which the option appears is entered in the location column. See Fig. 7 (R entry).

## 4. FUNCTIONAL SCHEMATICS

**4.01** A general description of FSs is given in 1.06 and 1.07.

**4.02** The rules covering the methods of showing information in an FS, together with detailed explanations of the symbols used, are given in Fig. 8.

**4.03** The number of FSs in a circuit depends on the size and type of circuit. Circuits that perform several different functions will have several FSs, whereas a small circuit, such as a trunk, might have only one FS.

**4.04** Each FS is given a number and a title. The title may indicate a circuit function, such as Pulse Counting, or the name of the circuit, such as Trunk Circuit.

**4.05** As will be observed upon examination of Fig. 8, there are two basic symbols used for contacts, as follows:

(a) A line with a superimposed X is used for a make contact (open when unoperated).

(b) A line with a superimposed bar is used for a break contact (closed when unoperated).

The two symbols are used together to form the various combinations of associated springs. These contact symbols are designed to allow a circuit path to be shown by straight lines without continual offsets, as would be required if the armature spring and arrowed contacts were used to represent contacts.

**4.06** It will also be observed that the battery symbol employed consists of the spelled out battery voltage rather than a battery symbol.

**4.07** The symbols used on FSs are, in general, the same as have been standard in the past.

**4.08** Use is made in FSs of abbreviations and condensing patterns. However, an FS always contains sufficient detail to permit a person familiar with the rules, but not necessarily familiar with the scope of the circuit, to interpret and apply the information.

**4.09** In most cases, an FS is limited to one sheet of the drawing and portrays only one function or subfunction of the circuit.

**4.10** One of the features of FSs is the showing of the circuit paths complete from battery to ground, which involves in some cases extending the paths beyond the circuit boundary. As illustrated in Fig. 8, Sheet 2, all external circuit information is enclosed within a double-line box.

## 5. APPARATUS FIGURES

### A. General

**5.01** A general description of APP FIGs. is given in 1.08.

**5.02** The amount of apparatus contained in an APP FIG. is the number of relays, resistors, etc, that can be conveniently manufactured or ordered as a unit. When only one or two pieces of apparatus is required, a separate APP FIG. may be shown, or the apparatus may be shown as a letter-designated option within another APP FIG.

**5.03** The contents of an APP FIG. are governed by equipment, manufacturing, and optional ordering considerations, and are not affected by the content of any particular FS. Therefore, one APP FIG. may combine apparatus appearing on more than one FS.

**5.04** Depending on circumstances, an APP FIG. may be nonoptional, meaning that it is always furnished; optional as a whole; or optional in part.

**5.05** Fig. 9 shows the method of listing the various types of apparatus in an APP FIG. Practically all apparatus is listed in the APP FIG.; notable exceptions are mounting plates, lamp sockets, and tube sockets. For each piece of apparatus listed, the following information is shown:

(a) Type of apparatus (relay, capacitor, etc).

(b) Functional designation.

(c) Location on the FS of each component part.

(d) Apparatus option designations.

(e) Code (complete ordering information).

(f) Type of contact components and their sequence characteristics. Either of two methods is used to show this information. One is a pictorial representation using familiar contact symbols of the attached-contact-type schematic. This method is used for apparatus having contact springs that are numbered individually, such as U-type relays. The other method is tabular in form and employs abbreviations to represent contact-type and sequence characteristics. For wire-spring relays, the following abbreviations are used.

M — Make
B — Break
EM — Early Make
EB — Early Break
BM — Break-Make (Nonsequence transfer)
EBM — Early Break-Make (Sequence transfer)
EMB — Early Make-Break (Continuity)
PM — Preliminary Make
PB — Preliminary Break
PMEB — Preliminary Make — Early Break (Preliminary transfer with respect to late contacts)
PBEM — Preliminary Break — Early Make (Preliminary continuity with respect to late contacts)

**5.06** Whenever more than one functional designation is associated with a single code, the required quantity of the coded apparatus is shown in brackets (see capacitors and networks in Fig. 9, Sheet 3.)

**5.07** Whenever practicable, the information in an APP FIG. is shown in tabular form. The methods used to show information for specific types of apparatus are discussed in detail in the following paragraphs of this part.

### B. Wire-spring General Purpose Relays

**5.08** Wire-spring general purpose relays are listed in one of two tabular forms, as shown in Fig. 9, Sheet 1, and described as follows:

(a) The table for relays with twelve contact positions is shown under APP FIG. 1 and accommodates as many as 12 relays. Reading across, it will be noted that the table is divided into major columns formed by heavy vertical lines. Each column contains the information for a particular relay. An additional column at each end of the table shows the type of information listed for each relay. For example, starting at the upper left-hand corner of the table and reading across:

(1) The DESIG line shows the functional designation of each relay.

(2) The CODE line shows the code of each relay.

(3) The OPTION line shows the option (if any) for the relay.

(4) The numbers 12 down to 1 refer to the contact position numbers. The contact arrangement of a particular position on a particular relay is determined by reading across from the spring position number to the CONT ARR (contact arrangement) column. If no contact arrangement is given in the table (see MAN relay, contacts 3, 5, 9, and 11), the interpretation is that the relay is not equipped with contacts in that position. The location on the FS of the contacts provided in a particular position is determined by reading across to the LOC (location) column. If no location information is given for a contact (see F relay, contacts 5 and 7), the interpretation is that the contact is not used in the circuit.

(5) The COIL line shows the FS location of the relay coil.

(b) The table for relays with 24 contact positions is as shown in Fig. 9, Sheet 2 for the AJ702 relays, and may accommodate as many as 20 relays. This table is similar, in some respects, to the table described for the 12 contact position relays. The table is divided into major columns formed by heavy vertical lines. Each column contains the information for a particular relay. An additional column at each end of the table shows the type of information listed for each relay. Note that no column is included on this table for indicating the contact arrangement. This is because the contacts of the 24 contact position relays are either all "makes" or all "breaks". Starting at the upper left-hand corner and reading across:

(1) The DESIG line shows the functional designation of each relay.

(2) The CODE line shows the code of each relay.

(3) The OPTION line shows the option (if any) for the relay.

(4) The numbers 24 down to 1 refer to the contact position numbers. The location on the FS of a particular contact of a particular relay is determined by reading across from the contact number to the vertical column for the relay.

(5) The COIL line shows the location on the FS of the coil for each relay.

**5.09** ***Dual Armature Relays:*** Dual armature relays such as the AK type are listed in the same table as other general purpose wire-spring relays as illustrated by the MB-SK relay in Fig. 9, Sheet 1 under APP FIG. 1. The information for this type of relay covers two adjacent major columns of the table, each half of the relay being entered in its own column. Each half of this type of relay has a maximum of five contact positions. Contact springs 1 to 5 and the associated coil (terminals 1L and 2L) form the lower half of the relay. Contact springs 8 to 12 and the associated coil (terminals 1U and 2U) form the upper half of the relay. Because of this division of contact numbering only five contacts are tabulated in each of the adjacent columns of the APP FIG.

**5.10** ***Split Contacts:*** When separate functions in different FSs are controlled by the make and break contacts of a transfer contact having direct battery or ground on its common spring, the transfer may be split into its make and break components in the FS. This is done to avoid leads between FSs. The double location is given by a footnote to which reference is made by letters a, b, etc, in the LOC column for each split transfer. This is illustrated in APP FIG. 1, relay ON, contact 4.

**5.11** ***Options:*** If, because of options, a contact is shown in more than one location on the FS, the same method of showing the location is used as described above for split contacts. This is illustrated in APP FIG. 1, relay SR, contact 6; and relay ST, contacts 12 and 5, and the coil.

### C. Wire-spring Multicontact Relays

**5.12** Wire-spring multicontact relays are listed in the tabular form, as shown in Fig. 9, Sheet 1, for the 286A, 287A, and 288A relays. These tables are similar to the table described previously for 24 contact position general purpose wire-spring relays. Note that no column is included on these tables for indicating the contact arrangement. This is because all contacts of the wire-spring multicontact relays are "makes."

**5.13** The 286A relay consists of a single unit having a coil and 30 springs. The table for this relay is divided into major columns formed by the heavy vertical lines. Each column contains

the information for a particular relay. A column at the left-hand side of the table shows the type of information listed for each relay. For example, starting at the upper left-hand corner and reading across:

(a) The DESIG line shows the functional designation of each relay.

(b) The CODE line shows the code of each relay.

(c) The OPTION line shows the options (if any) for the relay.

(d) The numbers 54 down to 0 refer to the contact numbers. The location on the FS of a particular contact of a particular relay is determined by reading across from the contact number to the vertical column for the relay.

(e) The COIL line shows the location on the FS of the coil for each relay.

**5.14** The 287A and 288A relays consist of two units (upper and lower), each having a coil and 30 springs. The methods used for covering these double-unit relays in the APP FIG. are in general the same as described above for the 286A relay.

### D. Dry Reed Relays

**5.15** Dry reed relays may be tabulated in several different ways as shown on Fig. 9, Sheet 2. The arrangement of the coils and contacts is shown in the diagram to the left of the designation and location information.

(a) Where all of the parts of a 293-type relay are grouped together at one location in the FS, the APP FIG. information is tabulated as illustrated by the A0, 1, 2, 4, 7, the B0, 1, 2, 3, 4, 7, etc, entries. The columns giving the location information are arranged as follows:

(1) The DESIG column lists the functional designation of each relay unit used in the circuit. For example, A0, 1, 2, 4, 7 indicates that coils 1, 2, 3, 4 and 5 are used; CT0, 1, 2 indicates that coils 1, 2 and 3 are used; CVA, VG10, CN, CR, TN indicates that coils 1, 2, 3, 4, and 5 are used. With each coil, a coil contact and load contact having the same designation are shown on the FS.

(2) The LOCATION column shows the location on the FS of the items listed in the subcolumns. For example, the COIL column lists the location of the coils and the associated A (coil) contacts. The B CONT column lists the location of the B (load) contacts.

(3) Option indications, where required, are shown to the left of the functional designations.

(4) The quantity indication, in brackets placed at the left of the designation, indicates that only one 293A relay is required to obtain the relays covered in each listing.

(b) Where the parts of a 293-type relay are scattered throughout the FSs, the APP FIG. information is tabulated as illustrated by the BA, BB, BC, BD, BE, and the DR1D, DR2D, DR3D, DR4D, DR5D entries. This table accommodates a convenient number of relays. Reading across, the table is divided into major columns formed by heavy vertical lines. Each major column is further divided into five parts and contains the information for each relay unit of a particular relay. A column at the left end of the table shows the type of information listed for each relay. Another column of this nature is shown at the right end of the table when more than three relays are listed. Starting at the upper left-hand corner of the table and reading across:

(1) The DESIG line shows the functional designation of each relay unit.

(2) The CODE line shows the code of each relay.

(3) The OPTION line shows the option (if any) for the relay.

(4) The COIL line is divided into two lines. The POS line shows the coil position number. The LOC line shows the FS location of the coils of the relay.

(5) The CONT POS line is divided into two lines. The A LOC line shows the FS location for the A contact of the relay units. The B LOC line shows the FS location for the B contact of the relay units.

(c) The table for the 295-type relays accommodates a convenient number of relays. Reading across, the table is divided into major columns formed by heavy vertical lines. Each column contains the information for a particular relay. A column at the left end of the table shows the type of information listed for each relay. Another column of this nature is shown at the right end of the table when more than eight relays are listed. Starting at the upper left-hand corner of the table and reading across:

(1) The DESIG line shows the functional designation of each relay.

(2) The CODE line shows the code of each relay.

(3) The OPTION line shows the option (if any) for the relay.

(4) The CONT line is divided into six lines, namely, F, E, D, C, B, A. These six lines show the FS locations for the A, B, C, D, E, and F contacts of the relay.

(5) The COIL line shows the FS location of the relay coil.

### E. Mercury Contact Relays

**5.16** Mercury contact relays (see tables for 275- and 276-type relays in Fig. 9, Sheet 1) are shown individually or in tabular form. If there is more than one relay of a type, the tabular form is generally used. As will be noted, the table is similar to those described previously except that the numbers in the left-hand column refer to the terminal numbers of the relays. Because of the different internal contact arrangements of these relays, the arrangement is illustrated to the left of the table. For each different arrangement, a separate illustration and table is shown. Split contact appearances on the FS are shown as described for wire-spring general purpose relays in 5.10 (see JM relay).

### F. General Relay Tabular Form

**5.17** Except as noted above for relays of the wire-spring, dry reed, and mercury contact types, if an APP FIG. contains relays having the same code, they are listed in the manner shown for the UB6002 relay or the S63 relay, Fig. 9, Sheet 1. The table is arranged as follows:

(a) The designations to the right of the relay code are the relay functional designations. All information shown under each designation applies to the same relay.

(b) Any option designation applying to the relay is shown directly under the relay designation (see KA2 relay).

(c) The location on the FS of the coil or a particular contact of a particular relay is determined by reading across from the symbol in the illustration to the relay designation column.

### G. Individual Relays

**5.18** Individual relays are listed as shown for the GT, CLR, RL and TR, and IC relays in Fig. 9, Sheet 1. Such relays are shown as follows:

(a) They are grouped together, and the group is headed by the word RELAY.

(b) The convention for each relay is shown.

(c) The code is shown above each convention.

(d) The relay functional designation is shown above the code.

(e) Option designations, if any, are shown to the left of the functional designation (see GT relay).

(f) The location on the FS is shown adjacent to each detached part of the relay.

The 266-type relays consist of two R-type relays permanently joined. The left- and right-hand units are referred to as ICL and ICR, and are so indicated in the FS. The IC relay illustrated is a 266A. This relay has a set of make contacts which are actuated by the cover cap. At these contacts in the FS the notation is made that they are operated by the cap.

### H. Capacitors

**5.19** Capacitors are listed in the APP FIG. in tabular form, as shown in Fig. 9, Sheet 3. The LOC column lists the location on the FS of each capacitor. Option and quantity indications, if required, are shown to the left of the functional designation. The table includes all coded capacitance units that are not part of coded networks. Complete ordering information is given in the CODE column.

### I. Cords

**5.20** Cords are illustrated in the APP FIG. as shown in Fig. 9, Sheet 3. No location information is given unless the cord is shown on an FS.

### J. Fuses

**5.21** Fuses are listed as shown in Fig. 9, Sheet 3.

### K. Jacks

**5.22** Jacks are listed as shown in Fig. 9, Sheet 3.

**5.23** When a jack is not shown in a detached manner, one set of location coordinates is, of course, sufficient to locate the jack on the FS. In such cases, the jack is listed in a table as shown for jacks A, B, L14, etc.

**5.24** When a jack is shown in a detached manner, the standard jack convention is illustrated, together with a table giving the functional designations, location coordinates, and code information (see L and M jacks). This arrangement is similar to that for individual relays. The contacts of each jack are numbered, with the jack viewed from the wiring side to permit identification of the detached contacts of the jack in the FSs.

### L. Keys and Keytops

**5.25** As will be noted from Fig. 9, Sheet 3, an individual diagram is given for each different functionally designated key. The functional designations appear above the diagrams for push-button- and turn-button-type keys. This is illustrated by the LINE PERF and EMER RESET keys, which are push-button-type keys, and by the 2/5 CHECK key, which is a turn-button-type key. For lever-type keys, the functional designations are located as illustrated by the NORTH-SOUTH and EAST-WEST keys. The code number of the key appears at the top of the diagram, as illustrated. If options are involved, the option designation appears to the left of the functional designation or code number.

**5.26** The springs of each key are numbered to permit identification of the detached contacts of the key in the FS.

(a) Lever-type keys are divided into quadrants which are identified by the letters A, B, C, and D. The lettering of the quadrants is fixed in relation to the front of the key. The front of the key is defined as the end where the key code is stamped. The operation of the key lever towards the front of the key always operates the springs in the A and D quadrants. The quadrants are arranged in the diagrams so that the springs of the key are pictured in the same position as they appear to a person working on the wiring side of the equipment. If the key is mounted so that it is rotated either 90 or 180 degrees, the quadrants rotate accordingly. In each quadrant, the springs are numbered from the plunger out. The plunger is represented by a single- or double-ended arrow. In the example shown in Fig. 9, Sheet 3, the NORTH-SOUTH key diagram shows the front of the 479DW key towards the bottom of the frame as seen from the wiring side. In the EAST-WEST key diagram, the view shown is for a 479DW key mounted in a keyshelf as seen when the keyshelf is raised to permit access to the wiring side of the key. In this case, the front of the key is toward the front of the keyshelf.

(b) The springs of push-button and turn-button keys that are mounted with their contact terminals in a horizontal or vertical array, as viewed from the wiring side, are numbered from left to right or bottom to top, respectively. When this type of key is mounted with its terminal array in other than a horizontal or vertical position, the terminals are numbered as follows:

(1) When the key is mounted so that the terminal array is positioned 45 degrees or less from the horizontal, the key is considered as being rotated the shortest distance necessary to bring the array into horizontal alignment, and the terminals are numbered from left to right.

(2) When the key is mounted so that the terminal array is positioned more than

45 degrees (but less than 90) from the horizontal, the key is considered as being rotated the shortest distance necessary to bring the array into vertical alignment and the terminals are numbered from bottom to top.

**5.27** A keytop diagram is given for each different functionally designated key and indicates the position in which a key is mounted in the equipment. Keytop diagrams, however, are not shown for individually-mounted pushbutton keys which have only one operating position. For lever-type keys, non-normal orientation resulting in the code being positioned at top or left in vertical panel or toward hinge in closed keyshelf is indicated with the word "FRONT" appropriately located in the keytop diagram. The word "FRONT" is not shown when key is normally mounted with code at bottom or right in vertical panel or toward front of closed keyshelf. Keytop diagrams in Fig. 9, Sheet 3, illustrate normal and non-normal orientation of lever-type keys.

### M. Lamps and Networks

**5.28** The APP FIG. information for lamps and networks is presented in tabular form, as shown in Fig. 9, Sheet 3. Built-up-type contact protection, which consists of a coded capacitor and a coded resistor, is not listed under networks; the individual parts are listed under capacitors and resistors.

### N. Outlets and Receptacles, Potentiometers, Rectifiers, and Regulators

**5.29** The APP FIG. information for this type of apparatus is presented in tabular form, as shown in Fig. 9, Sheet 4.

### O. Resistors

**5.30** Resistors are listed in tabular form as shown in Fig. 9, Sheet 4. Option and quantity indications, when required, are shown to the left of the functional designation. Note that the ordering information under the heading CODE is complete but varies, depending upon the type of resistor, for example

(a) For resistors A and B, the codes 18AG and 19GH are sufficient since these particular codes define the resistance value and the tolerance.

(b) For resistor C, the code 145B defines the type and the tolerance but not the resistance value. Therefore, the resistance value is shown.

(c) For resistor D, the required tolerance is specified by L1, L2, or L3 (corresponding to ±5 per cent, ±10 per cent, or ±20 per cent. Also, the required resistance value is shown.

### P. Selectors

**5.31** Selectors are shown in tabular form as illustrated in Fig. 9, Sheet 4. Starting at the left, the columns give the following information. Functional designation, option (if any), selector code and bank code. The ARC column is divided into a number of columns, one for each arc of the bank. Where the terminals of each arc are at one location in the FS, one locating coordinate is shown in the column. Where the terminals of any arc are at more than one location in the FS, the arc columns are subdivided into two columns, one designated TERM, which lists the terminals of the arc and the other designated LOC which lists the FS location of the terminals. The next major column is designated STEP MAG LOC and shows the location of the core of the stepping magnet. The last column, designated INT CONT LOC, lists the location of the interrupter contacts. In some cases, where the interrupter contacts are composed of several springs, a spring combination symbol is shown in this column and the locations of the individual springs are given.

### Q. Switches

**5.32** Fig. 9, Sheet 4 shows the APP FIG. arrangements for various types of switches.

**5.33** Single-pole toggle switches (CLP, PLP, etc) are covered by a table showing the functional designation, the location, and the code number.

**5.34** A double-pole, double-throw toggle switch is covered as illustrated by the MB switch.

**5.35** Section-type switches are listed in several ways depending upon the switch and its use in the FS.

(a) Switches with only one circuit per section and having the contacts at one location in the FS are covered as illustrated by the AUD TEST switch. Where the contacts are at more than one location in the FS, the switch is covered by a table as illustrated by the FREQ switch. This table shows the functional designation, code, option (if any), and location of the terminals of the various parts of the sections.

(b) Switches with more than one circuit per section are covered by a table as illustrated by the S switch. This table shows the functional designation, option (if any), code, and location of the terminals of the circuits of the various sections.

**5.36** Crossbar switches are covered in tables arranged in various ways, depending on how the switch is employed in the circuit. The illustrations in Fig. 9, Sheet 4 cover a number of different usages; these, with some minor variations, are adequate to cover most conditions that will occur.

### R. Thermistors, Transformers, Transistors, Tubes, and Varistors

**5.37** The tables at the bottom of Fig. 9, Sheet 4 show the methods for covering the above types of apparatus.

## 6. NOTES AND GENERAL CIRCUIT INFORMATION

### A. Circuit Notes

**6.01** Notes pertaining to the operation of the circuit are called Circuit Notes and are assigned to the 100 series.

**Fusing Information**

**6.02** Circuit Note 101 is always the fusing note. This note is in tabular form, and gives information for the battery, ground, and tone supply leads.

**6.03** Fig. 10 shows a fusing note. It is divided into either four or five columns, arranged as follows:

(a) The DESIG column lists the designation of the battery, ground, and tone supply leads. This is also the designation of the fuse when the lead is fused.

(b) The FUSE AMP column lists the rated capacitance of the fuses.

(c) The POTENTIAL column lists the nominal potential of the power supply leads and the designation of tone leads.

(d) The ONE PER column indicates that one fuse is needed for each part of the circuit listed in the column.

(e) On circuits for which connecting block terminals are shown on the FS and in which the power is supplied through connecting block terminals, an added column designated TERM. DESIG shows the block and terminal to which the supply leads are connected. If the terminal differs for different options, the option designation is shown (in a circle) to the left of the block designation.

Explanatory notes and the voltage limits of the circuit are shown at the bottom of the table.

**Feature or Option Information**

**6.04** Circuit Note 102 is always the feature or option note. This note is in tabular form, and shows the apparatus and wiring required to obtain desired features and options.

**6.05** Fig. 11 shows a feature or option note. It is arranged as follows:

(a) The FEATURE OR OPTION column lists the features or options for which the circuit can be arranged.

(b) The APP FIG. column shows the APP FIG. number (or numbers) that must be provided to obtain the feature or option.

(c) The APP OR WIR column shows the optional apparatus or wiring, or both (designated by letters), that must be provided to obtain the option.

(d) The QUANTITY column shows the quantity of each APP FIG. that must be provided to obtain the feature or option.

**Network Information**

**6.06** Circuit Note 103 is always the network values note. This note is in tabular form and shows the resistance and capacitance of the networks used in the circuit. If no networks are used in a circuit, the note is reserved for network information that may be required on later issues of the drawing.

**6.07** The term network refers to a coded apparatus unit containing a resistor and capacitor. The term applies whether the unit is used for contact protection, termination for a transmission line, or for any other purpose.

**6.08** Fig. 12 shows a network value note. It is divided into three columns, arranged as follows.

(a) The NETWORK NO. column lists the arbitrarily assigned numbers that are shown as part of network symbols throughout the FSs. These numbers are for reference as to value only and do not indicate the functional designation of the networks.

(b) The RESISTANCE IN OHMS column lists the nominal value, in ohms, of the resistance part of the network.

(c) The CAPACITANCE IN $\mu$f column lists the nominal value, in microfarads, of the capacitance part of the network.

**Job Record Information**

**6.09** Circuit Note 104 is always the job record note. Usually no job record note is provided on Issue 1, but the note is reserved for later issues. This note is used to record the changes that have been made on various issues of the drawing.

**6.10** Additional circuit notes may be shown covering other information relating to the operation of the circuit. These are numbered from note 105 up.

### B. Equipment Notes

**6.11** The 200 series notes are reserved for equipment information, and are referred to as Equipment Notes. These notes are primarily intended for use in the preparation of manufacturing information. They may also be used by the installer. They cover mounting restrictions of apparatus, size of wires, length of leads, balancing of capacitors, resistance of leads, running of leads, etc. The following is an example of an equipment note. "Where more than 70 SC relays are provided, the sleeve leads shall be cabled directly to the SC relays."

### C. Information Notes

**6.12** The 300 series notes, referred to as Information Notes, are reserved for information of a general nature which cannot be correctly listed with the other categories of notes. They cover interrupted intervals or timing, normal post springs, position of switches, direction of transmission, block diagrams, theory schematics, etc.

### D. Cross-connection Information

**6.13** Information required for assigning and making cross connections that are subject to periodic changes is sometimes given in the SD, usually in a cross-connection information table. Any explanatory notes are assigned to the 400 series. This information is required by the field in order to determine

(a) The conditions that require specific terminals to be cross connected.

(b) How to locate the punchings on the equipment. (The designations of the terminal strips and punchings.)

(c) The type and color of wire used to cross connect specific punchings.

**6.14** Two methods of presenting cross-connection information in the circuit drawing are described below.

(a) All the information is placed in tables (D group sheets on sectionalized drawings), with references, if required, to notes in the 400 series. These notes are a combination of explanations and schematics.

(b) The information is placed in a series of FSs numbered in the next available 100 group to the regular FSs. Each FS shows the cross connection between specific punchings (or groups of punchings) and in some cases shows the complete circuit to the punchings. References are made in the FSs to the 400 series notes which explain the conditions under which the cross-connections are made.

### E. Transmission Test Requirements Information

**6.15** Where required, the allowable transmission losses for an entire transmission circuit and for individual pieces of apparatus affecting transmission in the circuit are listed in tabular form. Fig. 14 shows a Transmission Test Requirements Table. These tables are described in detail in Section A804.003.

### F. Working Limits Information

**6.16** The working limits information shown on SDs may include the following:

(a) Maximum external circuit loop.

(b) Minimum external circuit loop.

(c) Maximum conductor loop.

(d) Minimum insulation resistance.

(e) Earth potentials.

(f) Sleeve resistance.

(g) Voltage limits for different maximum external circuit loops.

Fig. 15 shows the layout of a typical Working Limits Table.

## 7. SEQUENCE CHARTS

**7.01** A general description of SCs is given in 1.09.

**7.02** As many SCs are furnished as are considered necessary to explain the operation of the circuit. Each "usage" may be covered by a separate SC. A usage of the circuit may be the operation on normal calls, the operation on abandoned calls, the operation of the timing part of the circuit, etc.

**7.03** Although SCs are presented on a "circuit" basis, related operations of connecting circuits are included when necessary in order to

preserve continuity of operation of a call. Thus, a connected story is given even though the functions involve a number of other circuits. The responsibility for continuity of description lies with the major circuit of a system.

**7.04** Each SC is given a number and a title. The title shows the usage or function that the SC covers, such as Establishing Connection, Operator Answers At Distant End, Timing, etc.

**7.05** To interpret an SC, an understanding of the rules governing their arrangement and the symbols used is required. Fig. 16 shows this information.

**7.06** On very large sectionalized circuits, an index may be provided as the first item in the E group of sheets covering the sequence charts. This index shows the location on the SCs of the operate and release symbols of each relay, electron tube, etc. Fig. 17 illustrates such an index. It is arranged by circuits rather than by SCs. The index in a particular SD drawing lists the information for that SD first, and then follows with the information for connecting circuits. The title of each circuit is shown horizontally at the head of the associated group of information.

**7.07** The index is divided into three columns, arranged as follows:

(a) The DESIG column lists the functional designations of the apparatus. Number designations are listed first in numerical order and are followed by letter designations in alphabetical order. Electron tubes are listed with the relays and the word TUBE is placed under the designation. If an option designation, in addition to a functional designation, is required to identify a particular relay, the option designation is shown (circled) to the right of the functional designation.

(b) The OPR column lists the SC sheet and location coordinates of the operate symbols of the apparatus. If the designation appears on more than one SC location, information is given for each appearance. If the designation occurs repeatedly in an SC, the number of the SC may be listed instead. To avoid repetition and to conserve space, the drawing group designation for Sequence Charts (E) is omitted from the SC sheet number.

(c) In a similar manner, the RLS column lists the location information for the release symbols of the apparatus.

## 8. CIRCUIT REQUIREMENTS TABLES

**8.01** The Circuit Requirements Table (CRT) gives the electrical and/or mechanical requirements for relays and other apparatus, as required. It also covers the requirements for certain electron tubes. It gives the procedures (in the form of block and insulate directions and notes) to be followed when testing or readjusting the apparatus. This procedure lists all information necessary for taking equipment out of service, but it assumes that the equipment has been made busy.

**8.02** The block and insulate procedures are required in order to

(a) Prevent interference with the reading on the test set, locally or over paths from or through connecting circuits.

(b) Prevent interference with connecting circuits.

(c) Prevent the operation of alarms, traffic and plant registers, and lamps and signals on other frames or before operators. If registers cannot be protected by blocking or insulating, a CRT note specifies that local instructions should be followed with regard to recording the registrations.

(d) Prevent the blowing of fuses and the removal of make-busy conditions.

(e) Prevent contact with hazardous voltages.

**8.03** The sheets containing the CRT are arranged so that, if desired, they may be removed from the SD, cut into individual CRTs, and filed in 8-1/2-inch by 11-inch binders. Fig. 18 shows the arrangement of a CRT.

**8.04** CRTs are described in detail in Section A804.001.

## 9. TIMING REQUIREMENTS TABLES

**9.01** The Timing Requirements Table (TRT) gives the timing requirements applied to certain relays, tubes, and relay interrupter circuits. Fig. 19 illustrates the arrangement of a

Timing Requirements Table on a sheet of detached-contact-type SD. The Section A804.001 contains a detailed description of TRTs.

## 10. CABLING DIAGRAMS

**10.01** The cable connections between a circuit and other parts of the plant are shown in Cabling Diagrams (CADs). These are consecutively numbered and give all the information required for cabling. As shown in Fig. 20, CADs are arranged as follows:

(a) The associated APP FIG. number (or numbers) is shown directly below the CAD number.

(b) The type of cabling and wiring is indicated. The conventions and symbols used for this purpose are explained in Section A804.009, AA610.004 and 005-108-111.

(c) The title of the connecting circuit or apparatus is shown at the ends of connecting leads.

(d) The destination of each lead to the local circuit is given in sufficient detail so that it can be traced on the FS.

(e) Terminal strips are designated and the terminals numbered.

(f) Optional wiring and optional APP FIGs. are indicated.

(g) The method of interconnecting CADs is indicated.

## 11. LOCATING INFORMATION IN THE DRAWING

**11.01** The various items of information contained in the detached-contact-type SD drawing are readily found by means of the indexes, the sheet coordinates, and the cross-referencing arrangements furnished as part of each drawing. The following paragraphs illustrate means whereby typical items of information are located.

### FS Information

**11.02** To locate any piece of apparatus, refer to the Apparatus Index.

**11.03** To locate contacts of relays, jacks, etc, refer to the Apparatus Index and find the APP FIG. for the relay, jack, etc, having the required functional designation. Next, find the APP FIG. by referring to the Sheet Index or by scanning the sheets of the drawing. When the APP FIG. is found, look under relays, jacks, etc, for the required functional designation. When found, the FS sheet coordinates for the particular contact of the relay, jack, etc, will be seen associated with the contact.

**11.04** To determine the resistance and capacitance of networks, note the number shown in the network symbol on the FS. Next, refer to Circuit Note 103, the Network Values Note, where the resistance and capacitance for the corresponding number will be found. The code of the network is given in the APP FIG.

**11.05** Leads to connecting circuits are traced as follows (assuming that a lead is being traced from circuit G to circuit H). In circuit G, note the designation of the lead and the title of the connecting circuit (circuit H in this case). In the SD for circuit H, in the Lead Index, find the title for circuit G. Under this title find the designation of the lead; from the designation, determine the FS sheet number and location of the lead in circuit H.

### APP FIG. Information

**11.06** To determine the complete ordering information for any piece of apparatus, refer to the Apparatus Index and determine the APP FIG. for the apparatus. Next, locate the APP FIG. by referring to the Sheet Index or by scanning the sheets of the drawing. When the APP FIG. is located, find the particular piece of apparatus where the complete ordering information will be found.

### SC Information

**11.07** To determine the SC (or SCs) in which a relay, electron tube, switch, etc, is shown, refer to the SC Index.

## 12. CIRCUIT DESCRIPTIONS

**12.01** A Circuit Description (CD) is issued for each detached-contact-type SD drawing. In general, they contain the same type of information as given in the CDs for attached-contact SDs. The arrangement of the information in the CD for a detached-contact schematic is as follows:

### SECTION I — GENERAL DESCRIPTION

This covers the general use and/or purpose of the circuit and its general method of operation.

### SECTION II — DETAILED DESCRIPTION

This covers the detailed description of the circuit. In this section references are made to the SCs of the drawing.

### SECTION III — REFERENCE DATA

This covers the following information.

(a) Working limits of the circuit.

(b) Explanation of the functional designations of the operating elements used in the circuit.

(c) A list of the circuit functions.

(d) A list of the connecting circuits.

(e) Alarm information.

(f) Manufacturing test requirements.

(g) TEOS (taking equipment out of service) information.

### SECTION IV — REASONS FOR REISSUE

This describes and gives the reasons for changes made on reissue of the drawing.

### REASONS FOR REISSUE

1. 1.02 was added
2. 2.09 was revised to clearly describe the use of coordinates.
3. 3.01 was revised to indicate the latest practices of locating Sheet Indexes.
4. 3.02 and 3.03 were revised to incorporate information pertaining to the individual sheet reissue plan.
5. 3.06(c) was revised to add a means of locating apparatus in an APP FIG. that extends over several sheets.
6. 3.06(d) was revised to add reference to equipment mounted in cabinets or on panels.
7. 3.07 was revised to indicate when networks are listed in the Apparatus Index.
8. 3.08 was revised to add reference to CAD sheet locations.
9. 3.09(a) formerly indicated that the connecting circuit with the most leads was listed first.
10. 3.09(d) has been added to cover the CAD LOC column that has been added to the Lead Index table.
11. 3.10(a) was revised to add reference to letter designated APP FIGs.
12. 3.10(b)(1) and (2) were changed to indicate that the APP FIG. designation should be shown for locating optional APP FIGs. and apparatus.
13. 3.10(b)(3) was revised to add reference to wiring options that appear only in CADs.
14. 5.06 was revised to state when quantity indications are required.
15. 5.08(b) was added to cover APP FIG. information for the 24 contact position-type relays.
16. 5.09 was added to cover information concerning dual armature type relays.
17. 5.15(b) was added to describe an alternate method of showing 293-type relays in an APP FIG. 5.15(c)was added to provide information for the 295-type relays.
18. 5.18 was revised to add information concerning the contacts of a 266A relay that are operated by the cover cap.
19. 5.21 was added to give information concerning fuses.
20. 5.27 was added to describe keytop diagrams.
21. 5.31 was added to cover selectors.
22. 5.35 was revised to add reference to the FREQ and S switches.
23. Fig. 1 was revised to show the Sheet Index arrangement when a drawing is on an individual sheet reissue basis.
24. Fig. 2 was added in order to illustrate the Sheet Index arrangement for a nonsectionalized drawing that is arranged on an individual sheet reissue basis.
25. Fig. 6 was revised to add the CAD LOC column to the Lead Index.

26. Fig. 7 was revised to apply the latest method of locating optional APP FIGs. and apparatus.

27. Fig. 8 was revised as follows:

(a) Note 14 was added to indicate the method of showing normally operated relays.

(b) The method of splitting a multiwound relay was added to item 4.

(c) Item 10 was added to illustrate double transfer contacts.

(d) Item 11 was added to illustrate interrupter and off-normal contacts.

(e) Item 14 was revised to illustrate the method used in detaching jack springs.

(f) Item 17 was added to illustrate the method of showing trouble record information.

(g) Item 19 was added to cover connector terminals.

(h) Item 22 was revised to add reference to rotary switches and to show the latest illustration for this type of switch or selector.

(i) Item 24 was added to illustrate alarm type fuses.

(j) Item 25 was revised to reverse the order of assignment of the S leads.

(k) Item 30 was revised to add an illustration of the unenclosed appearance of the contact.

(l) Item 52 was revised to add reference to lettered circuit figures when converting attached-contact-type schematics to detached-contact-type schematics.

(m) Item A was revised to illustrate optional wiring between a number of points.

(n) Item C was revised to add the method of showing looping around a relay cove.

(o) Item E was revised to clearly define the use of arrowed circles.

(p) Item H was revised to indicate the circumstances under which option designations may be omitted.

(q) Item I was added to provide a method of indicating letter designated APP FIGs.

(r) Item J was added to illustrate the use of negative options which occur when converting attached-contact-type schematics to detached-contact-type schematics.

28. Fig. 9 was revised to

(a) Add illustrations of the dual armature-type relay, the 295-type dry reed relay, and the 24 contact position wire-spring relay.

(b) Illustrate alternate tabular information for the 293-type dry reed relay.

(c) Show the latest symbol for the 235-type relays.

(d) Add fuse information.

(e) Show the latest method of numbering jack terminals.

(f) Illustrate the latest method of showing keys.

(g) Add a number of network illustrations.

(h) Add an illustration of a rotary-type switch and a selector.

(i) Add a switch top illustration.

29. Fig. 16, item 15 was added to illustrate an alternative action pattern.

30. Fig. 16, item 16 was revised to indicate the use of functional designations and coordinates at interconnections of SCs.

31. Fig. 16, item 18 was revised to include reference to the trouble ticketer.

32. Fig. 18 was revised to illustrate dual armature relay and electron tube circuit requirements information.

33. Reference to tubes was removed from Fig. 19.

## SHEET INDEX

| CONTENTS | SHEET NO. | ISSUE NO. 1 | 2 | 3 | 4 | 5 | SHEET NO. |
|---|---|---|---|---|---|---|---|
| SHEET INDEX<br>SUPPORTING INFORMATION | A1 | 1 | 2 | 3 | 4 | 5 | A1 |
| APPARATUS INDEX<br>LEAD INDEX<br>OPTION INDEX | A2 | 1 | 2 | 2 | 2 | 5 | A2 |
| FS 1 - REGISTER CONTROL<br>FS 2 - REGISTER TEST | B1 | 1 | 2 | 2 | 2 | 5 | B1 |
| FS 3 - PULSE COUNTING<br>FS 4 - DIGIT STEERING | B2 | 1 | 2 | 2 | 2 | 2 | B2 |
| FS 5 - DIGIT REGISTRATION | B3 | 1 | 2 | 2 | 2 | 2 | B3 |
| FS 6 - CONNECTOR SELECTION<br>FS 7 - PLANT AND TRAFFIC REGISTERS | B4 | 1 | 2 | 2 | 2 | 5 | B4 |
| FS 8 - OVERALL TIMING AND TROUBLE RELEASE<br>FS 9 - LINK ALARM AND TROUBLE RELEASE TIMING<br>FS 10 - ALARMS | B5 | 1 | 2 | 3 | 3 | 5 | B5 |
| APP FIG. 1 | C1 | 1 | 2 | 3 | 4 | 5 | C1 |
| CIRCUIT NOTES 101-110<br>WORKING LIMITS | D1 | 1 | 1 | 3 | 3 | 5 | D1 |
| CIRCUIT NOTES 111 TO END<br>EQUIPMENT NOTES<br>INFORMATION NOTES | D2 | | | 3 | 3 | 5 | D2 |
| SC 1 - NORMAL CALL | E1 | 1 | 1 | 1 | 1 | 1 | E1 |
| SC 2 - LINK ALARM TIMING<br>SC 3 - TROUBLE RELEASE TIMING<br>SC 4 - STUCK REGISTER TIMING<br>SC 5 - PERMANENT SIGNAL TIMING<br>SC 6 - PARTIAL DIAL TIMING<br>SC 7 - NO SENDER ATTACHED | E2 | 1 | 2 | 2 | 2 | 5 | E2 |
| CKT REQ TABLES RELS ICA-SAP | F1 | 1 | 2 | 3 | 4 | 5 | F1 |
| CKT REQ TABLE SC TO END<br>TIMING REQ TABLE | F2 | 1 | 2 | 2 | 2 | 2 | F2 |
| CAD 1,2,3,4 | G1 | 1 | 2 | 3 | 3 | 3 | G1 |

Fig. 1 – Sheet Index for Sectionalized Drawing

## SHEET INDEX

| CONTENTS | SHEET NO. | ISSUE NO. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | SHEET NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHEET INDEX<br>SUPPORTING INFORMATION<br>APPARATUS INDEX<br>LEAD INDEX<br>OPTION INDEX | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| CIRCUIT NOTES<br>INFORMATION NOTES<br>TRANSMISSION TEST REQ TABLE | 2 | 1 | 1 | 3 | 4 | 4 | 6 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| FS 1 T,R & S LEADS | 3 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| FS 2 REGISTER LINK-SENDER LINK & TRUNK LINK & CONNECTOR CKT CONTROL | 4 | 1 | 1 | 1 | 4 | 4 | 4 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| FS 3 CHARGE CONTROL FEATURES<br>FS 4 CHARGE DELAY INTERRUPTER RELAYS, CHARGE DELAY<br>FS 5 CHARGE DELAY INTERRUPTER PROTECTION | 5 | 1 | 2 | 2 | 4 | 4 | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| APP FIGS. 1,2,3 | 6 | 1 | 2 | 3 | 4 | 4 | 4 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| SC 1 NORMAL CALL | 7 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| SC 2 END OF TIMED DISCONNECT CALL<br>SC 3 ABANDONED CALLS | 8 | 1 | 1 | 1 | 4 | 4 | 4 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 |
| SC 4 NON-CHARGE CALL | 9 | 1 | 1 | 1 | 4 | 4 | 4 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| CKT REQ TABLES | 10 | 1 | 1 | 3 | 4 | 5 | 5 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 10 |
| CAD 1 | 11 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 |

Fig. 2 – Sheet Index for Nonsectionalized Drawing Arranged for Individual Sheet Reissue

## SHEET INDEX

| SHEET NO. | CONTENTS |
|---|---|
| 1 | SHEET INDEX<br>APPARATUS INDEX<br>LEAD INDEX<br>OPTION INDEX<br>TRANSMISSION TEST REQ TABLE<br>WORKING LIMITS<br>CIRCUIT NOTES<br>EQUIPMENT NOTES<br>INFORMATION NOTES<br>SUPPORTING INFORMATION |
| 2 | FS 1 - TRUNK CKT |
| 3 | FS 2 - NO. 3C OR 3CL TOLL SWBD<br>FS 3 - NO. 1 TOLL SWBD |
| 4 | APP FIG. 1,2,3,4 |
| 5 | CKT REQ TABLE<br>CAD 1,2,3 |
| 6 | SC 1 - ESTABLISHING CONNECTION<br>SC 2 - CALL ABAMDONED<br>SC 3 - OPERATOR ANSWERS AT NO. 3C OR 3CL TOLL SWBD<br>SC 4 - OPERATOR ANSWERS AT NO. 1 TOLL SWBD |
| 7 | SC 5 - OPERATOR COLLECTS OR RETURNS COIN<br>SC 6 - OPERATOR DISCONNECTS<br>SC 7 - RECALLING SUBSCRIBER |

Fig. 3 – Sheet Index for Nonsectionalized Drawing Not Arranged for Individual Sheet Reissue

## SUPPORTING INFORMATION

| CATEGORY | NO. |
|---|---|
| EQUIPMENT DRAWINGS | J23055M-( )<br>J23055N-( ) |
| EQUIPMENT DESIGN REQ | J23055 |
| TRUNK TABLES | J29251 |

Fig. 4 – Supporting Information

Fig. 2, 3, 4

**APPARATUS INDEX**

| DESIG | LOCATION FS | APP FIG. | EQPT |
|---|---|---|---|
| **RELAYS** | | | |
| 11A | 6H5 | 18 | 1-10 |
| 11B | 6H6 | 18 | 1-10 |
| 11C | 6H7 | 18 | 1-10 |
| AG,1,2,4,7 | 11F3 | 13 | 1-5 |
| ABL | 8AN | 12 | 1-7 |
| ARBG | 12B2 | 10 | 1-6 |
| ATG-1 | 12A6 | 10 | 1-6 |
| AVG,1,2,4,7 | 8A3 | 7 | 2-14 |
| AV1G | 8AN | 7 | 2-14 |
| B | 12A3 | 9 | 1-3 |
| BK | 12C5 | 11 | 1-6 |
| T | 11F6 | 13 | 1-5 |
| T | 11F6 | 14 | 1-5 |
| **CAPACITORS** | | | |
| C | 4H5 | 10 | 1-7 |
| CR | 10F5 | 11 | 1-5 |
| T | 11F8 | 13 | 1-6 |
| **RESISTORS** | | | |
| CM | 8D8 | 17 | 1-7 |
| CR | 1A7 | 8 | 1-5 |
| TP | 1C2 | 12 | 1-6 |

Fig. 5 – Apparatus Index

**LEAD INDEX**

| DESIG | FS LOC | CAD LOC |
|---|---|---|
| **AUTOMATIC MONITOR REG & SCR TEST CKT** | | |
| BS | 11E5 | 14E3 |
| CN | 11E5 | 14E3 |
| FR | 11E5 | 14E3 |
| H | 11B1 | 14E5 |
| H | 11E5 | 14C1 |
| HB | 11B1 | 14C1 |
| MON | 11E5 | 14D3 |
| MST | 11E1 | 14C2 |
| N | 11E1 | 14C1 |
| **INC REG MKR CONN CKT** | | |
| 11 | 15G0 | 17B1 |
| AG,1,2,4,7 | 14E6 | 18B1 |
| BG,1,2,4,7 | 14G8 | 18E7 |
| BT | 11A5 | 17D3 |
| CG,1,2,4,7 | 14G6 | 17D3 |
| LT | 15F0 | 16F2 |
| M7 | 14H8 | 16F2 |

Fig. 6 – Lead Index

**OPTION INDEX**

| APP OR WIRING | LOCATION |
|---|---|
| 8 | APP FIG. 8 |
| 9 | APP FIG. 9 |
| 19 | APP FIG. 19, 64F7,6582-5502, 67C3,67G1,86A4, 86A5 |
| 20 | APP FIG. 20 |
| 21 | APP FIG. 21 |
| FIG. A | APP FIG. A |
| FIG. B | APP FIG. B |
| Z | 64H1,64H2,64H7, 67C2 |
| Y | APP FIG. 2, 30C3 |
| X | APP FIG. 4 |
| W | 30C3, 30D3 |
| V | 30C3, 30D3 |
| T | APP FIG. 3. |
| S | 85A3 |
| R | CAD 5 |
| Q | 86F6 |

Fig. 7 – Option Index

## NOTES

1. AN FS SHOWS THE INTER-CONNECTIONS REQUIRED IN A CIRCUIT FOR A FUNCTION OR A GROUP OF FUNCTIONS.
2. ALL WIRING, BOTH NONOPTIONAL AND OPTIONAL, AND ALL APPARATUS OPTIONS INVOLVED IN WIRING, ARE SHOWN IN THE FS.
3. THE SYMBOLS USED IN FS'S ARE ILLUSTRATED AND DESCRIBED IN THIS FIGURE; IF NOT SPECIFICALLY COVERED HEREIN, THE SYMBOLS FOR SCHEMATIC DRAWINGS ILLUSTRATED AND DESCRIBED IN BSP SECTION 005-108-111 ARE EMPLOYED.
4. A SYMBOL MAY BE TURNED IN ANY DIRECTION WITHOUT AFFECTING ITS MEANING.
5. EACH SYMBOL IS IDENTIFIED BY THE FUNCTIONAL DESIGNATION OF THE APPARATUS IT REPRESENTS. THE FUNCTIONAL DESIGNATION IS SHOWN IN HEAVY LETTERING WHEN ASSOCIATED WITH ACTIVE APPARATUS SUCH AS RELAY COILS, TUBES, ETC. WHEN ASSOCIATED WITH ATTACHED CONTACTS OF RELAYS, JACKS, KEYS, ETC., AND WITH CAPACITORS AND RESISTORS, THE FUNCTIONAL DESIGNATIONS ARE SHOWN IN LIGHT LETTERING.
6. AS ILLUSTRATED IN THIS FIGURE, A RELAY COIL IS DEPICTED BY A RECTANGLE. NOTE THAT:
   (A) THE RELAY WINDING RESISTANCE OHM SYMBOL IS NOT SHOWN.
   (B) RELAYS WITH PARTICULAR OPERATING FEATURES SUCH AS SLOW OPERATE, SLOW RELEASE, POLAR, ETC. HAVE AN ABBREVIATION WITHIN THE RECTANGLE SYMBOL THAT COVERS THE PARTICULAR OPERATING FEATURE WHICH APPLIES.
   (C) INNER-END SYMBOLS ARE NOT SHOWN FOR SINGLE-WOUND AND POLAR RELAYS; THEY ARE SHOWN FOR ALL OTHER TYPES OF RELAYS.
7. HEAVY LINES ARE USED FOR TALKING AND FUNDAMENTAL LEADS; ALL OTHER LEADS ARE SHOWN IN LIGHT LINES.
8. SHORT DASH LINES ARE USED TO INDICATE CIRCUIT PATH CONTINUITY THROUGH LIKE INTERMEDIATE CIRCUIT ELEMENTS, AND ALSO TO INDICATE OMITTED SECTIONS OF AN EXTERNAL CIRCUIT.
9. DETACHED PARTS OF APPARATUS COMPONENTS ARE IDENTIFIED BY BOTH THE FUNCTIONAL DESIGNATION OF THE APPARATUS TO WHICH THEY BELONG AND NUMBERS SHOWING THEIR PHYSICAL LOCATION ON THE APPARATUS COMPONENT.
10. DOUBLE-LINE BOXES ARE USED TO ENCLOSE INFORMATION FOR COMPLETING CIRCUIT PATHS ON AN FS. DETAILED INFORMATION WHICH IS SHOWN ELSEWHERE ON THE CIRCUIT OR IN ANOTHER CIRCUIT IS SHOWN WITHIN THE DOUBLE-LINE BOXES. THIS INFORMATION IS NOT INTENDED FOR WIRING PURPOSES.
11. UNASSIGNED CONTACTS OF RELAYS ARE NOT SHOWN IN THE FS.
12. AN FS IS USUALLY GIVEN A TITLE, WHICH IS SHOWN BELOW THE FS NUMBER.
13. COORDINATES ARE USED TO LOCATE THE POSITION OF APPARATUS ON EACH SHEET CONTAINING FS'S. LETTERS, EVENLY SPACED, ARE PLACED FROM TOP TO BOTTOM ON THE LEFT- AND RIGHT-HAND EDGES OF THE SHEET. NUMBERS, EVENLY SPACED, ARE PLACED FROM LEFT TO RIGHT ON THE TOP AND BOTTOM EDGES OF THE SHEET. THUS, COORDINATE B5 MEANS HORIZONTAL LINE B, VERTICAL COLUMN 5.
14. THE MAKE, BREAK, AND TRANSFER CONTACTS OF RELAYS THAT ARE NORMALLY OPERATED ARE SHOWN IN THE SAME MANNER AS THOSE OF RELAYS THAT ARE NORMALLY UNOPERATED.

## SYMBOLS

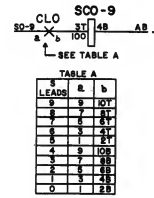
| | SYMBOL | MEANING |
|---|---|---|
| 1. | A — -48 | BATTERY. NEGATIVE SIDE OF -48 VOLT POSITIVE GROUNDED BATTERY. THE LETTER (WHEN USED) DESIGNATES THE FUSE THROUGH WHICH BATTERY IS FED TO THE APPARATUS. WHEN OTHER THAN -48 VOLT BATTERY IS REQUIRED, THE DESIRED VOLTAGE AND POLARITY IS SHOWN IN PLACE OF -48. |
| 2. | B | GROUND. THE LETTER (WHEN USED) DESIGNATES THE GROUND BUS TO WHICH THE LEAD IS CONNECTED. |
| 3. | SG; 5T 5B 2500 | SINGLE-WOUND RELAY OR COIL. SG IS THE FUNCTIONAL DESIGNATION, 2500 IS THE RESISTANCE OF THE WINDING IN OHMS, AND 5T AND 5B IDENTIFY THE WINDING TERMINALS. SO INDICATES THAT RELAY IS SLOW OPERATE. |
| 4. | HM; 4BF 7TF P-2500; 5BR 8TR S-2500; HM 4BF 7TF P-2500; HM 5BR 8TR S-2500 | MULTI-WOUND RELAY OR COIL. (SHOWN IN EITHER MANNER) HM IS THE FUNCTIONAL DESIGNATION, P AND S ARE PRIMARY AND SECONDARY WINDINGS OF 2500 OHMS EACH, AND 4BF, 7TF, 5BR, AND 8TR IDENTIFY THE WINDING TERMINALS. THE INNER ENDS OF THE WINDINGS ARE IDENTIFIED BY SOLID CIRCULAR SEGMENTS TO INDICATE RELATIVE POLARITY. |
| 5. | SG; 1 2T | MAKE CONTACT OF A RELAY HAVING TOP AND BOTTOM SPRING PILE-UPS. OPEN WHEN RELAY IS UNOPERATED, CLOSED WHEN RELAY IS OPERATED. SG IS THE FUNCTIONAL DESIGNATION OF THE RELAY, AND 1 AND 2T IDENTIFY THE NUMBER 1 AND 2 SPRINGS IN THE TOP PILE-UP. |
| 6. | HM; 1 | MAKE CONTACT OF A RELAY HAVING CONTACTS LOCATED IN DEFINITE NUMBERED POSITIONS ON THE RELAY STRUCTURE. OPEN WHEN RELAY IS UNOPERATED, CLOSED WHEN RELAY IS OPERATED. HM IS THE FUNCTIONAL DESIGNATION OF THE RELAY AND 1 IDENTIFIES THE FIXED SPRING OF THE NUMBER 1 SET OF CONTACTS. |
| 7. | SG; 3 4B | BREAK CONTACT OF A RELAY HAVING TOP AND BOTTOM SPRING PILE-UPS. CLOSED WHEN RELAY IS UNOPERATED, OPEN WHEN RELAY IS OPERATED. SG IS THE FUNCTIONAL DESIGNATION OF THE RELAY AND 3 AND 4B IDENTIFY THE NUMBER 3 AND 4 SPRINGS IN THE BOTTOM PILE-UP. |
| 8. | HM; 5 | BREAK CONTACT OF A RELAY HAVING CONTACTS LOCATED IN DEFINITE NUMBERED POSITIONS ON THE RELAY STRUCTURE. CLOSED WHEN RELAY IS UNOPERATED, OPEN WHEN RELAY IS OPERATED. HM IS THE FUNCTIONAL DESIGNATION OF THE RELAY AND 5 IDENTIFIES THE FIXED SPRING OF THE NUMBER 5 SET OF CONTACTS. |
| 9. | SG; HM; 6B; SG; HM | TRANSFER CONTACTS. THESE THREE-SPRING COMBINATIONS ARE SHOWN IN A VARIETY OF WAYS, AS ILLUSTRATED. CONTACT NUMBERS AND LETTERS ARE USED IN THE SAME MANNER AS EXPLAINED ABOVE FOR MAKES AND BREAKS. IN THE CASE OF THE HM RELAY, FOR EXAMPLE, THE SINGLE-NUMBER IS SHOWN FOR THE FIXED SPRING. THE CONTACT SEQUENCE, SUCH AS MAKE-BREAK (CONTINUITY) AND BREAK-MAKE (TRANSFER), IS COVERED IN THE APP FIG. DOTS USUALLY ARE NOT SHOWN AT JUNCTION POINTS OF THE MAKE AND BREAK, EXCEPT AS ILLUSTRATED ON SHEET 2 OF THIS FIGURE, ITEM 28, COVERING SYMMETRIC CIRCUITS. |
| 10. | A | DOUBLE TRANSFER CONTACTS. THIS TYPE OF SPRING COMBINATION MAY BE SHOWN IN VARIOUS WAYS AS ILLUSTRATED. IT CONSISTS OF 2 MAKE CONTACTS AND 2 BREAK CONTACTS ALL WITH A COMMON ARMATURE. A IS THE FUNCTIONAL DESIGNATION OF THE RELAY AND NUMBERS 1, 2, 4, AND 5 IDENTIFY THE FIXED SPRINGS AND NUMBER 3 IDENTIFIES THE MOVABLE SPRING. |
| 11. | AST O.N.; TA INT | INTERRUPTER AND OFF-NORMAL CONTACTS. AST AND TA ARE THE FUNCTIONAL DESIGNATIONS OF THE APPARATUS AND 3 AND 4 AND 1 AND 2 IDENTIFY THE SPRINGS. O.N. AND INT INDICATE OFF-NORMAL AND INTERRUPTER RESPECTIVELY. |
| 12. | TLK L KEY; TLK NL KEY | LEVER TYPE KEY CONTACTS. TLK IS THE FUNCTIONAL DESIGNATION OF THE KEY, AND 1 AND 2A IDENTIFY THE NUMBERS 1 AND 2 SPRINGS IN THE "A" QUADRANT. L OR NL PRECEDING THE WORD KEY DISTINGUISH BETWEEN LOCKING AND NON-LOCKING KEYS. THE CONTACT CONFIGURATION OF THE KEY AND THE NUMBER AND QUADRANT ASSIGNMENTS ARE SHOWN IN THE APP FIG. (SEE PARAGRAPH 5.26 OF BSP TEXT). |
| 13. | RING NL KEY; RING L KEY | PUSH-AND TURN-BUTTON KEY CONTACTS. RING IS THE FUNCTIONAL DESIGNATION OF THE KEY, AND 1 AND 2 IDENTIFY THE NUMBERS 1 AND 2 SPRINGS. L OR NL PRECEDING THE WORD KEY DISTINGUISH BETWEEN LOCKING AND NON-LOCKING KEYS. THE CONTACT CONFIGURATION OF THE KEY AND NUMBER ASSIGNMENT IS SHOWN IN THE APP FIG. (SEE PARAGRAPH 5.26 OF BSP TEXT.) |
| 14. | L JACK SLEEVE; L JACK TIP; L JACK RING | JACK SPRINGS. THE TIP, RING AND SLEEVE WITH WHICH THE PLUG MAKES CONTACT MAY BE SHOWN AS ILLUSTRATED. THE PARTS OF THE JACK ARE NUMBERED TO COORDINATE THEM IN THE FS AND APP FIG. |
| 15. | L JACK; L JACK; L JACK | JACK CONTACTS. CONTACTS OF JACKS MAY BE DETACHED AS ILLUSTRATED. L IS THE FUNCTIONAL DESIGNATION OF THE JACK; 5 AND 6 IDENTIFY BREAK CONTACT SPRINGS; 7 AND 8 IDENTIFY MAKE CONTACT SPRINGS; 2, 3, AND 4 IDENTIFY TRANSFER CONTACT SPRINGS. |
| 16. | H8 3C4 | LEADS. HE LEAD TO SHEET 3, AT LOCATION COORDINATE C4. |
| 17. | TCU; TMIX TK; TO MKR TST TBL RCDR CKT; OFX; ID; TO TBL TICKETER CKT | TROUBLE RECORD INFORMATION. A SOLID TRIANGLE (▼) BELOW A LEAD INDICATES THAT THE LEAD IS USED AS A TROUBLE RECORD LEAD AND CONTROLS THE PERFORATION OF A TROUBLE RECORD CARD, THE LIGHTING OF A LAMP IN A TROUBLE INDICATOR, OR THE PRINTING OF A NOTATION ON A TROUBLE TICKET. IN THE ILLUSTRATION, THE TCU3 LEAD DESIGNATION AGREES WITH THE DESIGNATION OF THE TROUBLE PUNCH OR LAMP. THE TMIX LEAD DESIGNATION DOES NOT AGREE WITH THE PUNCH OR LAMP DESIGNATION. THEREFORE, THE PUNCH OR LAMP DESIGNATION, TM, IS SHOWN ADJACENT TO THE SOLID TRIANGLE. THE TROUBLE TICKETER RECORDS TROUBLE BY PRINTING CHARACTERS ON A TICKET. THE LEADS THAT CONTROL THE PRINTING OF THE CHARACTERS ARE SHOWN ON THE FS AS ILLUSTRATED. THERE IS NO SIMILARITY BETWEEN THE CHARACTERS PRINTED ON THE TICKET AND THE LEAD DESIGNATIONS. THEREFORE, INFORMATION WHICH RELATES THE CHARACTERS TO THE LEAD DESIGNATIONS IS GIVEN IN TABULAR FORM AS AN INFORMATION NOTE ON THE CIRCUIT WHICH DIRECTLY CONNECTS TO THE TROUBLE TICKETER OR CONNECTS TO A CIRCUIT WHICH ITSELF DIRECTLY CONNECTS TO THE TROUBLE TICKETER. |
| 18. | 87; JPLO | TERMINALS. CONNECTING BLOCK TERMINAL. THIS ILLUSTRATES TERMINAL 7 ON THE 8 TERMINAL STRIP. CROSS-CONNECTION TERMINAL. JPLO IS THE FUNCTIONAL DESIGNATION. THE LOCATION OF THE TERMINAL IS GIVEN IN THE CROSS-CONNECTION INFORMATION. |
| 19. | A 6; A 6 | CONNECTOR TERMINALS. MALE AND FEMALE CONTACTS OF MATING CONNECTORS. THE FUNCTIONAL DESIGNATION A AND THE CONTACT TERMINAL NUMBER 6 ARE SHOWN ONCE WHERE THE TWO CONNECTORS ARE SHOWN IN ONE LOCATION IN THE FS. WHERE THE MATING CONNECTORS ARE SEPARATED THE FUNCTIONAL DESIGNATION AND THE CONTACT TERMINAL NUMBER ARE REPEATED AT EACH CONNECTOR. |
| 20. | TO TRAFFIC REG CKT; PS; PD; TO ALL OTHER DP SENDER CKTS; CD(A,B,C)1; 5T; 700; 48 | MULTIPLE CONNECTIONS. THE MULTIPLE SYMBOL MAY BE ACCOMPANIED BY AN EXPLANATORY NOTE. IN THIS ILLUSTRATION THE PS AND PD LEADS FROM ONE TRAFFIC REGISTER CIRCUIT CONNECT TO ALL OTHER DP SENDER CIRCUITS. WHEN THE MULTIPLE SYMBOL IS NOT ACCOMPANIED BY AN EXPLANATORY NOTE, BUT IS PLACED CLOSE TO A SYMBOL REPRESENTING MORE THAN ONE CIRCUIT ELEMENT TERMINAL, IT INDICATES THAT ALL OF THESE TERMINALS ARE MULTIPLED. IN THIS ILLUSTRATION, THE MULTIPLE SYMBOL INDICATES CONNECTION TO 5T OF RELAYS CDAI, CDBI, AND CDCI. THE TERMINAL TO WHICH DIRECT BATTERY OR DIRECT GROUND IS CONNECTED DOES NOT CARRY THE MULTIPLE SYMBOL. |
| 21. | C; B | CONTACT PROTECTION NETWORK. THE NUMBER WITHIN THE RECTANGLE REFERS TO THE CORRESPONDING ENTRY IN CIRCUIT NOTE 103, WHICH GIVES THE VALUES OF THE RESISTOR AND CAPACITOR THAT COMPRISE THE NETWORK. THE SYMBOL AT THE LEFT IS FOR A TWO-TERMINAL OR A FOUR-TERMINAL NETWORK; THE OTHER SYMBOL IS FOR A THREE-TERMINAL NETWORK. |
| 22. | DCK SEL ARC 1 NBG; ALL; 1; 17-22; 2; 4-8; 3; 10-12,15; 13,14,16; TST SW SECT 1 (FRONT) CKT A; 5 ALL; OFF 1; INT 2; FA ST 3; SLOW 4; FR SW; 6 300; 5 250,300; 2 100,150; 1 100; 150,200 3; 200,250 4 | ROTARY SWITCH OR SELECTOR. FOR SIMPLICITY, THE TERMINALS ARE ARRANGED IN A LINE AND ONE TERMINAL SYMBOL MAY REPRESENT A NUMBER OF TERMINALS, AS INDICATED BY THE PLURAL NUMBERING. DCK IS THE FUNCTIONAL DESIGNATION. SEL IDENTIFIES THE APPARATUS AS A SELECTOR. THE ARCS OF THE BANK ARE IDENTIFIED AS ARC 1, ARC 2, ETC. THE TYPE OF BRUSH IS SHOWN AS BRIDGING, BDG, OR NONBRIDGING, NBG. THE NUMBERS (OR LETTERS) AT THE ARROWHEADS REPRESENT THE POSITION DESIGNATIONS OF THE SELECTOR. THE NUMBERS AT THE TERMINALS IDENTIFY THE TERMINALS OF THE ARC OF THE BANK. THE TERMINAL DESIGNATED ALL REPRESENTS THE WIPER AND INDICATES THAT THE WIPER MAKES CONTACT IN ALL POSITIONS OF THE SELECTOR. THUS WHEN THE INDEX WHEEL INDICATES POSITION 1, THERE IS A CIRCUIT PATH THROUGH THE WIPER TO TERMINAL 2. WHEN THE INDEX WHEEL INDICATES POSITION 10, THERE IS A CIRCUIT PATH THROUGH THE WIPER TO TERMINALS 10, 11, 12, AND 15. TST AND FR ARE THE FUNCTIONAL DESIGNATIONS. SW INDICATES THAT THE APPARATUS IS A SWITCH. THE SECTIONS OF THE SWITCH, IF MORE THAN ONE, ARE INDICATED BY SECT 1, SECT 2, ETC. SECTION 1 IS THE SECTION NEAREST THE KNOB. WHERE THERE IS MORE THAN ONE CIRCUIT ON A SIDE OF A SECTION, EACH CIRCUIT IS IDENTIFIED AS CKT A, CKT B, ETC. WHERE A SECTION HAS A CIRCUIT OR CIRCUITS ON BOTH SIDES, FRONT INDICATES THE SIDE NEAREST THE KNOB. THE LETTERS (OR NUMBERS) AT THE ARROWHEADS REPRESENT THE SWITCH DESIGNATION OF THE POSITION OF THE SWITCH AT WHICH THE CONTACT IS MADE. THE NUMBERS AT THE TERMINALS IDENTIFY THE CONTACT TERMINALS WHICH ARE NUMBERED WITH THE SWITCH VIEWED FROM THE WIRING SIDE. THE POSITION DESIGNATION ALL INDICATES THAT CONTACT IS MADE IN ALL POSITIONS OF THE SWITCH. THUS WHEN THE TST SWITCH IS IN THE OFF POSITION THERE IS A CIRCUIT PATH FROM TERMINAL 5 TO TERMINAL 1. WHEN THE SWITCH IS IN THE FAST POSITION, THERE IS A CIRCUIT PATH FROM TERMINAL 5 TO TERMINAL 3. WHEN THE FR SWITCH IS IN THE 100 POSITION, THERE IS A CIRCUIT PATH FROM TERMINAL 1 TO TERMINAL 2. WHEN THE SWITCH IS IN POSITION 150, THERE IS A CIRCUIT PATH FROM TERMINAL 2 TO TERMINAL 3. IN SOME CASES THE SWITCH POSITION DESIGNATIONS CANNOT BE CONVENIENTLY SHOWN AT THE SWITCH SYMBOL. IN THESE CASES A TABLE OR SHEET NOTE MAY BE USED TO INDICATE THE ASSOCIATED CIRCUIT PATHS AND SWITCH POSITIONS. |
| 23. | | AMA READER CONTACTS. READING CONTACT. CONTACT CLOSES WHEN CAM-DRIVEN SENSING PIN FINDS PERFORATION IN TAPE. WHEN TAPE IS NOT PERFORATED, PIN TRAVEL IS BLOCKED AND CONTACT CLOSURE IS PREVENTED. CONTROL CONTACTS. BREAK CONTACT ILLUSTRATED AT LEFT, MAKE CONTACT AT RIGHT. THE MOVING SPRING OF THE CAM DRIVEN INTERRUPTER CONNECTOR IS ILLUSTRATED ABOVE THE CONTACTS. |
| 24. | A; POWER SOURCE; ALARM CKT; 3 AMP; LOAD | ALARM TYPE FUSE. A IS THE FUNCTIONAL DESIGNATION, IF REQUIRED, OF THE FUSE. THE FUSE CONTACT, MAKES WHEN THE FUSE OPERATES CONNECTING THE SOURCE OF POWER TO THE ALARM CIRCUIT. |

| POSITION NUMBER | POSITION DESIGNATION |
|---|---|
| 1 | OFF |
| 2 | ADJ POT |
| 3 | TEST HEAS |
| 4 | PULSE TEST |

**Fig. 8 — Functional Schematics — Methods of Showing Information**

SYMBOL

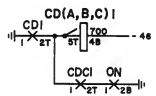
25.




MEANING

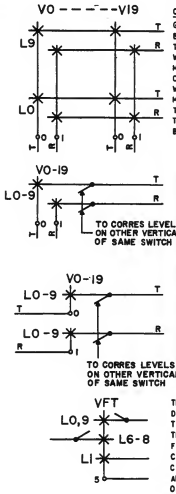
CIRCUIT CONDENSATION METHODS

THIS ILLUSTRATES THE USE OF A TABLE TO GIVE DETAILS OF CONTACT NUMBERING. THE ABSENCE OF A MULTIPLE SYMBOL INDICATES DUPLICATION OF INDIVIDUAL CIRCUITS. IN THIS ILLUSTRATION, SCO-9 INDICATES TEN RELAYS SCO TO SC9. TEN LEADS SO-9 ARE SHOWN CONNECTING THROUGH TEN INDIVIDUAL CONTACTS OF ONE CLO RELAY TO THE 3T TERMINALS OF TEN INDIVIDUAL RELAYS SCO-9.




THIS ILLUSTRATES ONE CIRCUIT WHICH INCLUDES THE WINDINGS OF THREE RELAY CORES CDA1, CDB1, AND CDC1 WIRED IN PARALLEL. ONE DESIGNATION AND ONE CORE SERVES FOR SEVERAL RELAYS. THE VARIABLE PART OF THE DESIGNATION IS ENCLOSED IN PARENTHESIS. THE MULTIPLE SIGN INDICATES THE POINT OF MULTIPLING.

26.




CROSSBAR SWITCH PATTERNS

GRID PATTERN. SWITCH VERTICALS ARE INDICATED BY VO TO V19 AND SWITCH LEVELS BY LO TO L9. TERMINALS ARE SHOWN FOR THE VERTICALS AND THE WIRE NUMBER IS PLACED ALONGSIDE OF THESE TERMINALS. AN X IS PLACED AT THE INTERSECTION OF VERTICAL AND HORIZONTAL LINES AT ALL POINTS WHERE CONNECTIONS FROM ONE TO THE OTHER MAY BE MADE BY OPERATION OF THE SWITCH. THE USE OF THE X SYMBOL AT THE INTERSECTION OF TWO LINES, THEREFORE, INDICATES THAT A MAKE CONTACT MUST BE OPERATED FOR INTER-CONNECTION.

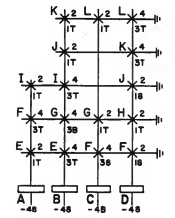
CONDENSED PATTERNS. USED WHEN ALL VERTICALS AND ALL HORIZONTALS ARE WIRED SIMILARLY.

THIS ILLUSTRATES THE METHOD USED TO INDICATE DIFFERENT WIRING APPLIED TO DIFFERENT HORIZONTAL LEVELS OF A CROSSBAR SWITCH. IN THE ILLUSTRATION, ONLY THE WIRING ASSOCIATED WITH THE FIFTH WIRE OF THE VERTICAL FT IS SHOWN. ONE CIRCUIT IS CONNECTED THROUGH LEVEL 1, ANOTHER CIRCUIT IS MULTIPLED THROUGH LEVELS 6, 7 AND 8, AND A THIRD CIRCUIT IS MULTIPLED THROUGH LEVELS 0 AND 9. LEVELS 2, 3, 4 AND 5 ARE UNUSED AND THEREFORE NOT SHOWN.

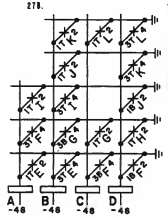
## SYMBOLS (CONT)

27A.

SYMBOL



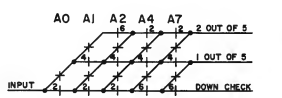

27B.




MEANING

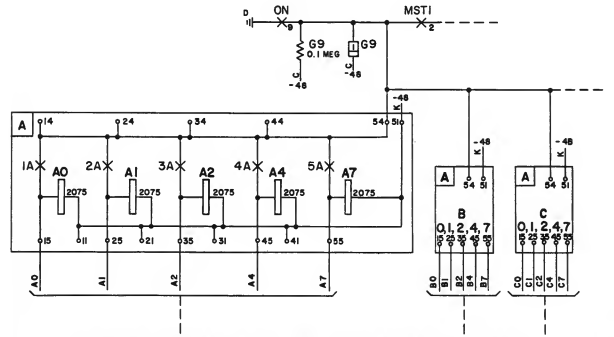
RELAY GRID PATTERN. THE ILLUSTRATION IN 27A IS AN ARRANGEMENT OF THE CIRCUIT PATHS OF RELAYS IN A GRID PATTERN. MAKE CONTACTS ARE PLACED AT THE POINTS OF INTERSECTION OF THE VERTICAL AND HORIZONTAL LINES. THE CONTACT NUMBERS INDICATE THE CONNECTIONS OF THE MAKE CONTACTS. THE ARRANGEMENT IN 27B IS NOT USED IN THE FS'S BUT IS SHOWN HERE TO HELP IN UNDERSTANDING 27A.

28.




SYMMETRIC CIRCUIT. IN THIS ILLUSTRATION THE CONTACTS ARE ARRANGED TO FURNISH ONE OUTPUT IF TWO OUT OF FIVE RELAYS AO, A1, A2, A4, A7 ARE OPERATED AT ONE TIME; ANOTHER OUTPUT IF ONE OUT OF THE FIVE IS OPERATED; AND A THIRD OUTPUT, CALLED A DOWN CHECK, IF NONE IS OPERATED. DOTS ARE SHOWN AT ALL JUNCTION POINTS. THE SPRING NUMBERING ILLUSTRATED IS FOR WIRE SPRING RELAYS.

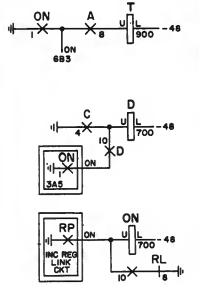
29.




REPEATED CIRCUIT PATTERN. WHEN A CIRCUIT PATTERN IS REPEATED ON THE SAME SHEET OF THE DRAWING, A SINGLE-LINE BOX MAY BE USED TO ENCLOSE THE COMPLETE DETAILS OF THE PATTERN AND OTHER SINGLE-LINE BOXES WITHOUT DETAILS THEN MAY BE USED TO INDICATE REPETITIONS OF THE CIRCUIT PATTERN. A BOLD LETTER DESIGNATION REPRESENTING THE PATTERN IS PLACED IN ONE OF THE CORNERS OF THE BOX CONTAINING COMPLETE DETAILS. SMALLER BOXES WITH THE SAME CORNER DESIGNATION BUT WITHOUT PATTERN DETAILS ARE USED TO REPRESENT REPETITIONS OF THE PATTERN. THE ABOVE ILLUSTRATION COVERS A DRY REED TYPE RELAY, WHICH CONSISTS OF FIVE RELAYS THAT ARE A PHYSICAL APPARATUS GROUP OBTAINED UNDER A SINGLE APPARATUS CODE NUMBER. REPEATED CIRCUIT PATTERNS MAY BE USED ALSO IN CASES INVOLVING MORE THAN ONE EQUIPMENT ITEM.

30.

SYMBOL




MEANING

EXTERNAL CIRCUIT INFORMATION

A DOUBLE-LINE BOX IS USED TO ENCLOSE CIRCUIT INFORMATION REPEATED TO AVOID THE NECESSITY OF REFERRING TO OTHER SHEETS OF THE DRAWING OR TO ANOTHER CIRCUIT DRAWING, WHEN ALL THAT IS REQUIRED IS A GENERAL UNDERSTANDING OF A CIRCUIT PATH. THE INFORMATION SHOWN WITHIN A DOUBLE-LINE BOX MAY BE INCOMPLETE, SINCE ONLY SUFFICIENT DETAILS ARE INCLUDED TO PORTRAY THE COMPLETED CIRCUIT PATH. ALSO, THE INFORMATION SHOWN IS NOT INTENDED FOR WIRING PURPOSES, SINCE IT IS REPEATED FROM EITHER ANOTHER FS OF THE SAME CIRCUIT OR FROM ANOTHER CIRCUIT.

THE NUMBER 1 CONTACT OF THE ON RELAY PROVIDES A LOCKING GROUND FOR RELAYS IN TWO DIFFERENT FS'S. AT THIS APPEARANCE THE CONTACT IS NOT ENCLOSED IN A DOUBLE-LINE BOX BUT REFERENCE (683) IS MADE TO THE OTHER APPEARANCES WHERE A DOUBLE-LINE BOX IS EMPLOYED. ONLY THE LOCATION OF THE UNENCLOSED APPEARANCE IS LISTED IN THE APP FIG.

AT THIS APPEARANCE THE DOUBLE-LINE BOX ENCLOSES THE PART OF THE CIRCUIT THAT IS REPEATED; IN THIS CASE THE NUMBER 1 CONTACT OF THE ON RELAY. REFERENCE (3A5) IS MADE TO THE LOCATION OF THE UNENCLOSED APPEARANCE.

IN THIS ILLUSTRATION, THE DOUBLE-LINE BOX IS USED TO EXTEND THE CIRCUIT PATH INTO ANOTHER CIRCUIT. IN THIS CASE, THE ON RELAY IS OPERATED OVER LEAD ON TO THE INCOMING REGISTER LINK CIRCUIT BY THE RP RELAY OF THE LINK. THE INFORMATION IN THE DOUBLE-LINE BOX IS NOT NECESSARILY COMPLETE AND CONTACT NUMBERS MAY BE OMITTED.

Fig. 8 – Functional Schematics — Methods of Showing Information (Contd)

51. ALL OPTIONAL WIRING AND OPTIONAL APPARATUS IS SHOWN IN THE FS.

52. ALL OPTIONAL INFORMATION IS ASSIGNED AN "OPTION DESIGNATION" CONSISTING OF EITHER LETTERS OR NUMBERS. THIS DESIGNATION IS SHOWN WITHIN A CIRCLE OR AN OVAL. TWO CONCENTRIC CIRCLES OR OVALS ARE USED TO ENCLOSE LETTERED CIRCUIT FIGURES OF ATTACHED-CONTACT TYPE SCHEMATICS WHEN CONVERTING TO DETACHED-CONTACT TYPE SCHEMATICS.

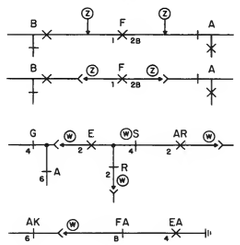
53. APPARATUS WHICH IS A PART OF, AND WIRING WHICH IS REQUIRED WITH, AN OPTIONAL APP FIG. IS DESIGNATED IN THE FS BY THE ENCIRCLED APP FIG. NUMBER, EXCEPT WHEN COVERED BY A LETTERED OPTION.

54. LETTERED OPTIONS ARE USED TO IDENTIFY OPTIONAL PORTIONS OF AN APP FIG. AND/OR OPTIONAL WIRING IN ANY PART OF THE CIRCUIT.

55. WHEN THE APPARATUS AND WIRING OF AN ENTIRE FS IS OPTIONAL, THE OPTION DESIGNATION IS PLACED TO THE LEFT OF THE FS NUMBER.

56. WHEN ONLY PARTS OF AN FS ARE OPTIONAL, THE OPTION DESIGNATIONS ARE PLACED SO AS TO CLEARLY LIMIT AND DEFINE THE SCOPE OF THE OPTION. TO HELP DO THIS, IN SOME CASES ARROWS ARE ATTACHED TO CIRCLES USED TO ENCOMPASS THE OPTION DESIGNATION.

SYMBOL



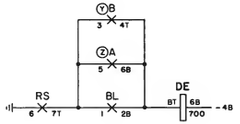
MEANING

WIRING ONLY OPTION.

OPTIONAL WIRING BETWEEN TWO POINTS MAY BE INDICATED IN EITHER OF THE WAYS ILLUSTRATED. RELAY F IS NOT OPTIONAL BUT THE WIRING TO THE 1-2B CONTACTS IS PROVIDED ONLY WHEN "Z" OPTION IS SPECIFIED.

OPTIONAL WIRING BETWEEN A NUMBER OF POINTS MAY BE SHOWN AS ILLUSTRATED. WIRING ORIGINATING AT AN ARROWHEAD CONTINUES UNTIL TERMINATED BY ANOTHER ARROWHEAD OR BY BATTERY, GROUND, A CONNECTION TO A CONNECTING CIRCUIT, OR ANY OTHER SIMILAR TERMINATION. IN THE ILLUSTRATION, ALL THE RELAYS EXCEPT THE S RELAY ARE NOT OPTIONAL. THE WIRING TO THE CONTACTS OF THE E,S,AR,R,FA AND EA RELAYS IS PROVIDED ONLY WHEN "W" OPTION IS SPECIFIED.

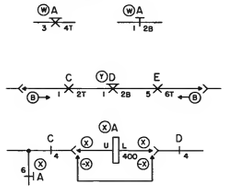
B.



WIRING AND APPARATUS OPTION. THE A AND B RELAYS AND THE ASSOCIATED WIRING ARE OPTIONAL.

## OPTIONS

C.



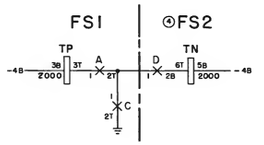
LOOPING

THE A RELAY IS OPTIONAL, BUT IF OPTION "W" IS NOT SPECIFIED THE WIRING IS NEVERTHELESS FURNISHED. THIS CONDITION IS REFERRED TO AS "LOOPING". THE CIRCUIT IS CONTINUOUS WHEN THE OPTION IS NOT SPECIFIED.

RELAYS C, D AND E ARE IN APP FIG. 8, WHICH IS OPTIONAL. RELAY D IS A SUB-OPTION OF APP FIG. B AND ITS CONTACT CAN BE LOOPED.

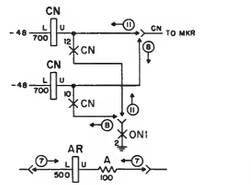
WHEN "X" OPTION IS NOT SPECIFIED THE COIL OF RELAY A IS LOOPED AS INDICATED BY "-X" OPTION.

D.



FS ENTIRELY OPTIONAL. FS 2 IS ENTIRELY OPTIONAL AND IS COVERED BY APPARATUS FIGURE OPTION 4. THE TN RELAY AND THE D RELAY ARE PART OF, BUT NOT NECESSARILY ALL OF, APPARATUS FIGURE OPTION 4. THIS ILLUSTRATION ALSO SHOWS HOW AN OPTIONAL FS MAY BE DIRECTLY JOINED TO A NON-OPTIONAL FS.

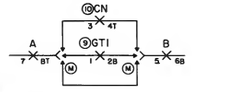
E.



FS PARTIALLY OPTIONAL. IN THIS CASE THE CN RELAYS ARE OPTIONAL AND THE ARROWED CIRCLES INDICATE THAT EVERYTHING BETWEEN THEM AND GROUND OR BATTERY IS OF THE SAME OPTION OR A SUB-DIVISION THEREOF.

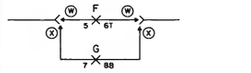
IN THIS CASE THE AR RELAY AND A RESISTOR ARE OPTIONAL AND THE ARROWED CIRCLES INDICATE THAT EVERYTHING BETWEEN THEM IS OF THE SAME OPTION OR A SUB-DIVISION THEREOF.

F.



WIRING OPTION FURNISHED IF APPARATUS OPTION IS NOT SPECIFIED. APP FIGS. 9 AND 10 ARE OPTIONAL, AND WHEN NEITHER IS FURNISHED WIRING OPTION "M" IS REQUIRED.

G.

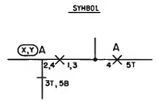


ALTERNATIVE OPTIONS. THE F AND G RELAYS ARE NOT OPTIONAL, BUT THEIR CONTACTS ARE WIRED ONLY IF "W" OR "X" OPTION IS SPECIFIED.

SYMBOL

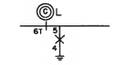
MEANING

H.



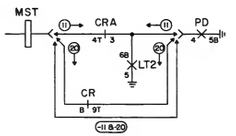
DIFFERENT WIRING FOR DIFFERENT OPTIONS. RELAY A IS OPTION "X" OR "Y". WHEN "X" OPTION IS WIRED CONTACTS 1,2,3T AND 4,5T ARE USED. WHEN "Y" OPTION IS WIRED CONTACTS 3,4,5B AND 4,5T ARE USED. WHERE THERE IS NO DIFFERENCE IN THE WIRING FOR THE DIFFERENT OPTIONS, THE OPTION DESIGNATIONS ARE OMITTED AS IN THE CASE OF CONTACTS 4,5T. THIS SAME METHOD IS USED FOR ALL APPARATUS WHERE THERE IS NO DIFFERENCE IN THE WIRING AND NUMBERING PROVIDED THE APPARATUS WAS INITIALLY NON-OPTIONAL.

I.



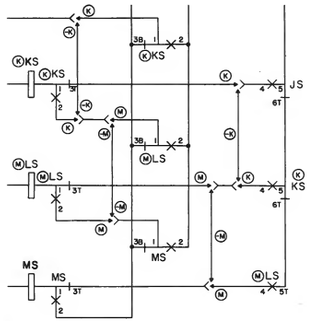
LETTER DESIGNATED APP FIG. LETTERED APPARATUS FIGURES OCCUR WHEN CONVERTING FROM ATTACHED-CONTACT SCHEMATICS TO DETACHED-CONTACT SCHEMATICS. L IS THE FUNCTIONAL DESIGNATION AND IS IN OPTIONAL APP FIG. C.

J.



NEGATIVE OPTION FOR USE WHEN CONVERTING ATTACHED-CONTACT SCHEMATICS TO DETACHED-CONTACT SCHEMATICS.

THERE ARE CASES ON ATTACHED-CONTACT SCHEMATICS WHERE THE STATEMENT "IF PROVIDED" IS SHOWN AT INTERFIGURE LEAD TERMINATIONS. THIS STATEMENT COVERS AN OPTION THAT MUST BE SHOWN WHEN THE DRAWING IS CONVERTED TO A DETACHED-CONTACT SCHEMATIC. THIS OPTION IS SHOWN AS A NEGATIVE OPTION. IN THE ILLUSTRATION, THE HST AND PD RELAYS ARE IN AN APP FIG. THAT IS ALWAYS PROVIDED. RELAYS CRA AND LT2 ARE IN OPTIONAL APP FIG. 11. RELAY CR IS IN OPTIONAL APP FIG. 20 WHEN NEITHER APP FIG. 11 NOR APP FIG. 20 IS PROVIDED, A CONNECTION MUST BE PROVIDED BETWEEN THE HST AND PD RELAYS. THIS CONNECTION IS COVERED BY OPTION "-11 & -20".



OPTIONS "-K" AND "-M" REPRESENT THE LOOPING OF NON-ASSOCIATED RELAY CONTACTS OF THE KS AND LS RELAYS RESPECTIVELY WHEN EITHER OR BOTH OF THESE RELAYS ARE OMITTED.

Fig. 8 – Functional Schematics — Methods of Showing Information (Contd)

# APP FIG. 1

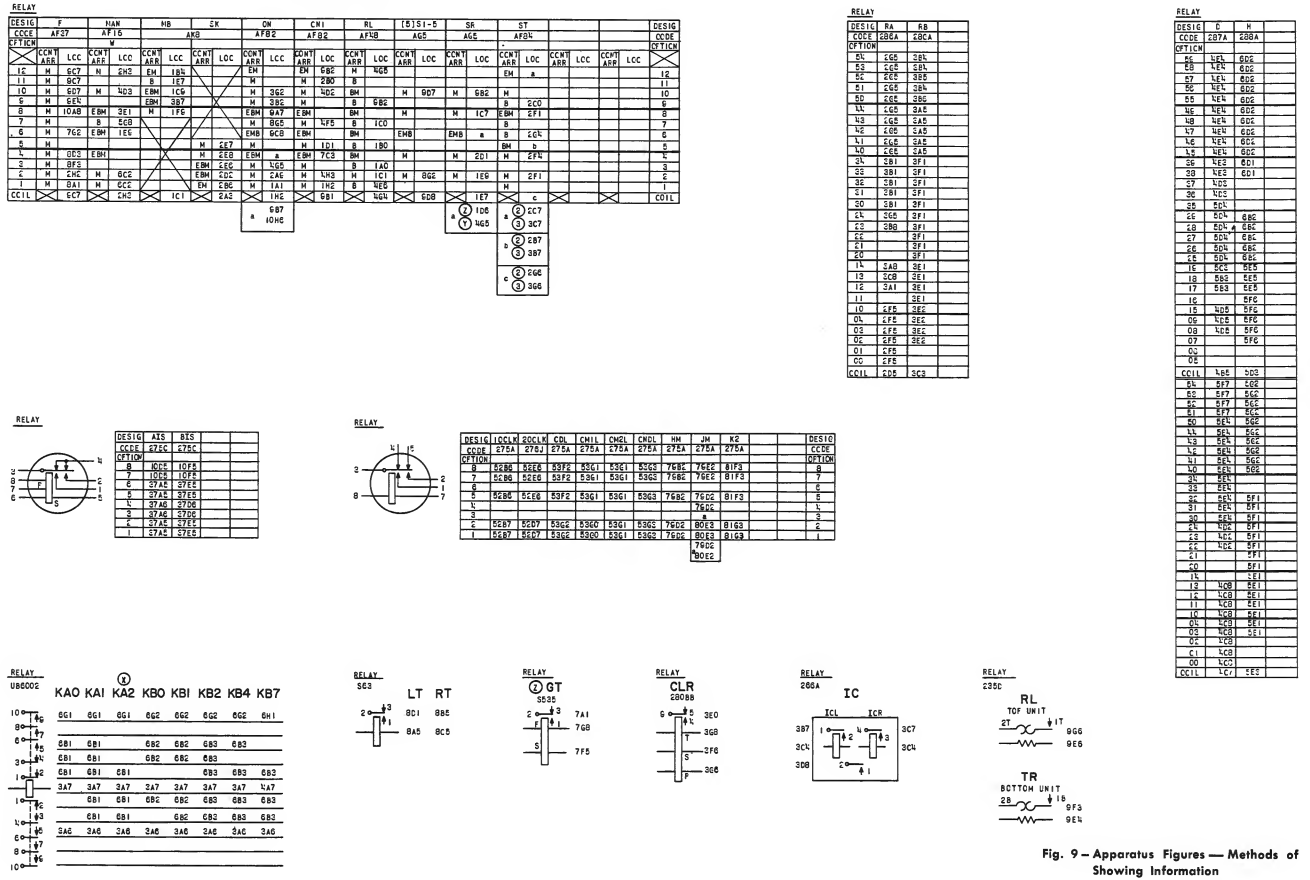
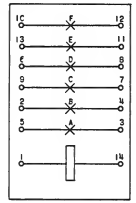



Fig. 9 – Apparatus Figures — Methods of Showing Information

RELAY

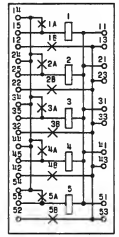
| DESIG | CTEA | CTFA | FCPA | FE1 | FE2 | FE3 | FE4 | FE5 | FE6 | FE7 | FE8 | FE9 | FE10 | FE11 | FE12 | FE13 | FE14 | FE15 | | | DESIG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CODE | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | AJ702 | | | CODE |
| OPTION | | | | | | | | | | | | | | | | | | | | | OPTION |
| 24 | 2CFB | | | 17DH | 17DH | 17DH | 17CH | 17DH | 17DH | 17CH | 17DH | 17DH | 17DH | 17DH | 17DH | 17DH | 17DH | 17DH | | | 24 |
| 23 | 19F7 | 2CB1 | | 19GB | 18GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | 18GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | | | 23 |
| 22 | 19FE | 2CB1 | | 19H7 | 19H7 | 19H7 | 19H7 | 19H7 | 19H7 | 18H7 | 19H7 | 19H7 | 18H7 | 19H7 | 19H7 | 19H7 | 19H7 | 19H7 | | | 22 |
| 21 | 19FE | 2CBC | | 22AN | 22AN | 22AN | 22AN | 22AN | 22AN | 22AN | 22AN | 22AN | 22AN | 22A4 | 22A7 | 22A7 | 22A7 | 22A7 | | | 21 |
| 20 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 20 |
| 18 | 19FB | 2DB2 | 22BE | | | | | | | | | | | | | | | | | | 19 |
| 18 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 18 |
| 17 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 17 |
| 1E | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 1E |
| 15 | 19FB | 2DB2 | 22BE | | | | | | | | | | | | | | | | | | 15 |
| 14 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 14 |
| 13 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 13 |
| 12 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 12 |
| 11 | 19FB | 2CB2 | 22BE | | | | | | | | | | | | | | | | | | 11 |
| 1C | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F8 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 10 |
| 9 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 9 |
| 8 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 8 |
| 7 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 7 |
| 6 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 6 |
| 5 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 5 |
| 4 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 4 |
| 3 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 3 |
| 2 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 2 |
| 1 | 19FB | 2CB2 | 22B2 | 22E7 | 22F7 | 22E7 | 22F7 | 22E8 | 22F8 | 22E8 | 22F8 | 22E9 | 22F9 | 22E3 | 22F3 | 22E3 | 22FN | 22E4 | | | 1 |
| COIL | 17FB | 17H2 | 2CDC | 19GB | 19GB | 18G9 | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19GB | 19G9 | 19GB | 19GB | | | COIL |

RELAY



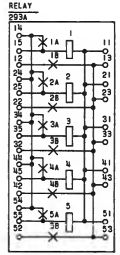

| DESIG | DM1 | DM2 | DM3 | DM4 | DM5 | DME | DM7 | DM8 | FRC1 | FRC2 | FPC3 | FPDN | | | DESIG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CODE | 295A | 295A | 295A | 295A | 295A | 295A | 295A | 295A | 295A | 295A | 295A | 295A | | | CODE |
| CPTION | | | | | | | | | | | | | | | CPTION |
| CONT | F | | | | | | | | 31F1 | | 31F3 | | | F | |
| | E | 31E8 | 31E8 | 31E9 | 31E8 | 31EV | 31EN | 31E5 | 31E5 | 31F1 | | 31F3 | | | E | |
| | D | 31E7 | 31E7 | 31E8 | 31E8 | 31E3 | 31EN | 31EN | 31EN | 31F1 | 31F2 | 31F3 | 31F3 | | D | CONT |
| | C | 31E6 | 31E6 | 31E7 | 31E7 | 31E2 | 31E2 | 31E3 | 31E3 | 31F1 | 31F2 | 31F3 | 31F3 | | C | |
| | B | 31E5 | 31E5 | 31E6 | 31E6 | 31E1 | 31E1 | 31E2 | 31E2 | 31F1 | 31F2 | 31F3 | 31F3 | | B | |
| | A | 31E2 | 31E3 | 31EN | 31E5 | 31E6 | 31E6 | 31E7 | 31E8 | 31FC | 31F2 | 31F3 | 31F3 | | A | |
| COIL | 31P2 | 31B1 | 31B3 | 31B3 | 31P5 | 31BN | 31B5 | 31B6 | 31A9 | 31BG | 31C8 | 31C9 | | | COIL |

RELAY




| DESIG | | BA | BB | BC | BD | BE | DR1D | DR2D | DR3D | DRNC | DR5D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CODE | | 293A | | | | | 293A | | | | |
| OPTION | | | | | | | 7A | | | | |
| COIL | PCS | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| | LCC | 3C1 | 3C1 | 3C2 | 3C2 | 3C4 | 19G5 | 20A1 | 18G5 | 19G5 | 23B5 |
| CONT | A LOC | 3C1 | 3C1 | 3C2 | 3C2 | 3C4 | 19G5 | 17B3 | 18D5 | 19G6 | 23C5 |
| POS | B LOC | 6B3 | 6B4 | 6B4 | 6B5 | 6B6 | 25E3 | 25E3 | 22A8 | 25E3 | 25E3 |

RELAY
293A




| DESIG | LOCATION | |
|---|---|---|
| | COIL | B CONT |
| (1) AD,1,2,4,7 | 3C1 | 6B3 |
| (1) BD,1,2,4,7 | 3D3 | 6C3 |
| (1) CD,1,2,4,7 | 3D4 | 6B6 |
| (1) CTD,1,2 | 3C3 | 3D3 |
| (1) CVA,VGIO,CN,CR,TN | 3B4 | 3D4 |
| (TE) (1) OD,1,2,4,7 | 3B5 | 3D5 |

Fig. 9 – Apparatus Figures — Methods of Showing Information (Contd)

CAPACITOR

| OESIG | LOC | CODE |
|---|---|---|
| A | 3K3 | 4W0A |
| B | 3K3 | KS-14330 |
| [1] R | 4B5 | 437A |
| [1] T | 4C3 | |
| S | 6E9 | KS-13368,L3, 0.001 UF |
| [2] W1,2 | 5C2 | KT-13368,L3, 0.001 UF |

CORD PATCHING

| OESIG | LOC | CODE |
|---|---|---|
| — | 7B8 | 2P4A |
| — | 7B6 | 2P4B |

CORD READER MOTOR LOC 16A4

HUBBELL NO. 7087 CAP. — HUBBELL NO. 7259 BODY

2 CONDUCTOR 18-AWG KS-15143 CORDAGE 3-1/2 FT LONG

FUSE

| OESIG | LOC | CODE |
|---|---|---|
| 20A | 3B5 | BUSSMAN AGS, 20 AMP |
| PF | 5D4 | 70A |

JACK

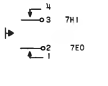
| OESIG | LOC | CODE |
|---|---|---|
| A | 7F7 | 3E4 |
| B | 7B2 | 3E4 |
| L16 | 8C1 | 1A1 |
| L15 | 3B5 | 1A1 |
| L17 | 5C8 | 1A1 |
| T | 2F5 | 239 |

JACK 2500

| | L | (Y) M |
|---|---|---|
| 1 | 16D7 | 16E7 |
| 2 | | |
| 3 | 15B3 | 15B3 |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 16D7 | 18E7 |
| 8 | | |

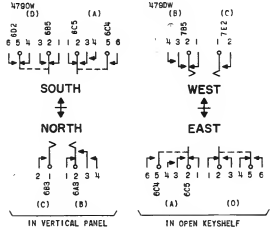
KEY
LINE PERF
92W

KEY
EMER RESET
92Y




KEY
(Y) 2/5 CHECK
272A

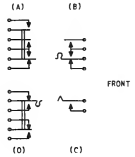
KEY
47904




KEY
47904

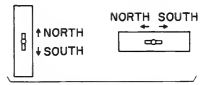



BELOW IS AN ILLUSTRATION OF HOW THE 4790W KEY APPEARS ON THE WECO CARD CATALOG WITH THE EXCEPTION THAT THE QUADRANT LETTERS A,B,C, AND D AND THE WORD "FRONT" ARE NOT SHOWN ON THE CARD CATALOG FIGURES. THIS ILLUSTRATION IS INCLUDED HERE ONLY AS AN AID IN INTERPRETING THE METHOD USED IN CONVERTING THE CARD CATALOG PICTURE TO THE APP FIG. SYMBOL AND IS NOT SHOWN IN THE APP FIGS. OF THE SD DRAWINGS.




KEY TOP
2/5 CHECK

KEY TOP
47904

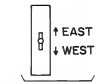



NORMAL ORIENTATION IN VERTICAL PANEL. CODE (FRONT) AT BOTTOM AND AT RIGHT.

KEY TOP
47904

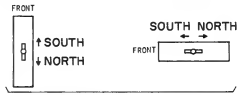



KEY TOP
47904




NORMAL ORIENTATION IN CLOSED KEYSHELF. CODE (FRONT) TOWARD OPERATOR

KEY TOP
47904

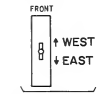



NON-NORMAL ORIENTATION IN VERTICAL PANEL INDICATED WITH THE WORD "FRONT". CODE (FRONT) AT TOP AND LEFT.

KEY TOP
47904




KEY TOP
47904




NON-NORMAL ORIENTATION IN CLOSED KEYSHELF INDICATED WITH WORD "FRONT". CODE (FRONT) TOWARD HINGE.

LAMP

| DESIG | LOC | CODE |
|---|---|---|
| ALARM | 13A4 | MAZDA 72 |
| CR | 1A9 | 13L (RES) |
| FA1 | 9C7 | 2Y |
| FA2 | 9C8 | 2Y |
| L1 | 703 | 2Y (RED) |

NETWORK

| | OESIG | LOC | CODE |
|---|---|---|---|
| [3] | A0,1,2 | 3A7 | 185A |
| | B1C | 6B9 | 180A |
| | G1A | 5C6 | 185A |
| | G2A | 5D6 | 185A |
| | P8 | 2A6 | 180A |
| [3] | RA0,1,2 | 3B5 | 185A |
| (Z) [5] | RB0,1,2,4,7 | 3D4 | 185A |
| | RH | 4B2 | 185A |
| [2] | S | 3G2 | 185A |
| [10] | T0-9 | 6C5 | 177C |
| [1] | TA- | 6F3 | 185A |
| [1] | TA- | 6F3 | 185A |
| [5] | TA0-9 | 7F2 | 177C |
| [10] | V0-9 | 4D4 | 185A |
| [1] | W | 705 | 177C |
| | W | 3B1 | |

**Fig. 9 – Apparatus Figures — Methods of Showing Information (Contd)**

OUTLET & RECEPTACLE

| DESIG | LOC | CODE |
|---|---|---|
| CAB | 9C2 | HUBBELL 52151-1/2 OUTLET BOX<br>EW 2-9575 OUTLETS |
| RECT | 984 | HUBBELL 7240 RECEPTACLE |

POTENTIOMETER

| DESIG | LOC | CODE |
|---|---|---|
| PPS ADJ | 9H5 | KS-5563,L3 |
| PPS CAL | 9H6 | G.R.CO. TYPE 301A |
| VOLTS ADJ | 9A5 | KS-13790,L2, 1.5 MEG |

RECTIFIER

| DESIG | LOC | CODE |
|---|---|---|
| RECTIFIER | 1N5 | J862568 |

REGULATOR

| DESIG | LOC | CODE |
|---|---|---|
| REGULATOR | 1H5 | KS-15631,L3 |

RESISTOR

| DESIG | LOC | CODE |
|---|---|---|
| A | 283 | 18AG |
| B | 284 | 19GH |
| C | 286 | 1458, 1000 |
| (Y) D | 287 | KS-13490,L1,1500 |
| (5) RO,1,2,4,7 | 389 | 18R |
| (X) (2) TO,1 | 7C4 | 18AG |

SELECTOR

| DESIG | OPTION | CODE | BANK CODE | ARC 1 TERM. | ARC 1 LOC | ARC 2 TERM. | ARC 2 LOC | ARC 3 TERM. | ARC 3 LOC | ARC 4 TERM. | ARC 4 LOC | ARC 5 TERM. | ARC 5 LOC | ARC 6 TERM. | ARC 6 LOC | STEP MAG LOC | INT CONT LOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Y | 206A | 26A | 1-4<br>5,6<br>7-18<br>19<br>20-22 | 703<br>704<br>7C3<br>7C1<br>704 | 1-22 | 6A4 | 1-22 | 804 | 1-10<br>11<br>12-21<br>22 | 983<br><br>9C3 | 1-20<br>21<br>22 | 9F7 | 1-22 | 10A2 | 783 | 785 |

SWITCH

| DESIG | L OR SL | | | |
|---|---|---|---|---|
| CODE | 3288 | | | |
| OPTION | | | | |
| LEVEL | WIRE | LOC | WIRE | LOC |
| 0-9 | 0-5 | 6E2 | | |
| | | | | |
| MAGNETS | HOLO | 6C1 | | |
| | SEL | 684 | | |
| SEL O.N.CONT | SO-9 | 684 | | |
| | S50-9 | 6C4 | | |
| | | | | |

SWITCH
324C

| SEL MAG | LOCATION COIL | LOCATION SEL O.N. CONT | HOLO MAG | HOLO O.N. CONT |
|---|---|---|---|---|
| 9 | 380 | 381 | | |
| 8 | 380 | 381 | | |
| 7 | 3C0 | 3C1 | | |
| 6 | 3D0 | 3D1 | | |
| 5 | 3E0 | 3E1 | | |
| 4 | 3E0 | 3E1 | | |
| 3 | 3F0 | 3F1 | | |
| 2 | 3G0 | 3G1 | | |
| 1 | 3H0 | 3H1 | | |
| 0 | 3H0 | 3H1 | | |

| DESIG | LOCATION IB | IG | FB | FT | FU | F |
|---|---|---|---|---|---|---|
| COIL | 389 | 3C9 | 3E9 | 3F9 | 3G9 | 3A9 |
| CONTACT NO. 1,2 | 3C7 | 3E7 | 3D7 | 3F7 | 5C8 | |
| CONTACT NO. 3,4 | 3C9 | 3C7 | 3E7 | 3F7 | 1A5 | 397 |
| CONTACT NO. 5 | 3C9 | 3C7 | 3E7 | 3F7 | 3G7 | 387 |
| CONTACT NO. 6 | | | | | 3G7 | |
| WIRE 0 | 487 | 4B4 | 407 | | | 4D3 |
| WIRE 1 | 486 | 486 | 4D6 | | | 4E3 |
| WIRE 2 | 487 | 485 | 407 | 4F8 | 4H8 | 4G5 |
| WIRE 3 | 488 | 485 | 4D6 | 4F8 | 4H8 | 4G5 |

SWITCH

| DESIG | J | | T | | | |
|---|---|---|---|---|---|---|
| CODE | 3258 | | 3258 | | | |
| OPTION | | | | | | |
| LEVEL | WIRE | LOC | WIRE | LOC | WIRE | LOC |
| 0-9 | 0 | 2A5 | 0 | 286 | | |
| 0-9 | 1,2 | 3A2 | 1,2 | 383 | | |
| MAGNETS | HOLO | 285 | HOLO | 2C4 | | |
| | SEL | 2E9 | SEL | 2F7 | | |

SWITCH

| DESIG | COMB. LINE & JUNCTOR SW | | LINE SWITCH | | | |
|---|---|---|---|---|---|---|
| CODE | 3250 | | 3250 | | | |
| OPTION | | | | | | |
| LEVEL | WIRE | LOC | WIRE | LOC | WIRE | LOC |
| 0-9 | 0 | 103 | 0 | 100 | | |
| 0-9 | 1 | 183 | 1 | 181 | | |
| 0-9 | 2 | 1A3 | 2 | 1A0 | | |
| MAGNETS | L HOLO | 100 | L HOLO | 100 | | |
| | J HOLO | 103 | NT HOLD | 103 | | |
| | LJ SEL | 1E1 | LO-9 SEL | 1E1 | | |
| HOLD O.N. CONT | 1T,2T | 1C1 | 1T,2T | 1C1 | | |
| | 3T,4T | 181 | 3T,4T | 180 | | |

SWITCH

| DESIG | FREQ | | | | | |
|---|---|---|---|---|---|---|
| CODE | KS-13546,L33 | | | | | |
| OPTION | | | | | | |
| SECT | 1 | | 2 | | 3 | |
| | TERM. | LOC | TERM. | LOC | TERM. | LOC |
| | 12-3<br>4-8<br>9-11 | 5A1<br>6A1<br>982 | 12-3<br>4-8<br>9-11 | 501<br>601<br>9C2 | 12-3<br>4-8<br>9-11 | 5E1<br>9E1<br>7C3 |

SWITCH

| DESIG | S | | | | | |
|---|---|---|---|---|---|---|
| CODE | KS-13546,L40 | | | | | |
| OPTION | | | | | | |
| CIRCUIT | A | | B | | C | |
| | TERM. | LOC | TERM. | LOC | TERM. | LOC |
| SECT 1 | 12-3 | 802 | 4-7 | 803 | 8-11 | 783 |
| SECT 2 | 12-3 | 6A3 | 4-7 | | 8-11 | 8A4 |
| SECT 3 | 12-3 | 705 | 4-7 | 882 | 8-11 | |

SWITCH

| DESIG | LOC | CODE |
|---|---|---|
| CLP | 7C5 | ESA-676800-42 |
| PLP | 7E5 | ESA-676800-42 |
| PLP' | 7E1 | ESA-676800-42 |
| PWR | 9A1 | HUBBELL 79C5<br>TOGGLE SWITCH |
| RLP | 785 | ESA-676800-42 |

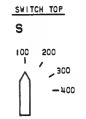
SWITCH
MB
KS-13535-C1,L1




SWITCH
AUD TEST
KS-13546,L33

| SECT | LOC |
|---|---|
| 1 | 788 |
| 2 | 787 |

SWITCH TOP
S




THERMISTOR

| DESIG | LOC | CODE |
|---|---|---|
| A | 984 | 8C |
| B | 985 | 8B |

TRANSFORMER

| DESIG | LOC | CODE |
|---|---|---|
| A | 1HG1 | 373F |
| B | 2C5 | 94E REP COIL |

TRANSISTOR

| DESIG | LOC | CODE |
|---|---|---|
| A | 684 | 2A |
| B | 584 | 3A |
| C | 584 | 3A |
| D | 708 | 2A |

TUBE, ELECTRON

| DESIG | LOC | CODE |
|---|---|---|
| CR1 | 7F4 | 313CC |
| CR2 | 7G4 | 313CC |
| TR | 2C2 | 353A |
| TR1 | 2D5 | 353A |

VARISTOR

| DESIG | LOC | CODE |
|---|---|---|
| PK | 388 | 400A |
| V | 2D4 | 330 |

**Fig. 9 – Apparatus Figures — Methods of Showing Information (Contd)**

101.

| DESIG | FUSE AMP | POTENTIAL | ONE PER | TERM. DESIG |
|---|---|---|---|---|
| A | 1/2NV | +130V SIG | REGISTER | A14, A24 H11, J22 |
| B | 1/2NV | -130V SIG | REGISTER ARRANGED FOR COIN LINES | N13 |
| C | 1/2NV | +130V SIG | REGISTER FRAME | A34 |
| | | | | |
| LT2 | 1/2 | DIAL TONE | REGISTER FRAME | |
| | | | | |
| A | 1-1/3 | -48V SIG | APP FIG. 1 | A11 |
| B | 1-1/3 | -48V SIG | APP FIG. 1 | A21 |
| C | 1-1/3 | -48V SIG | APP FIGS. 1,21 | A31 |
| D | 1-1/3 | -48V SIG | APP FIG. 14 | A41 |
| E | 1-1/3 | -48V SIG | APP FIGS. 5,6 | A12 |
| F | 1-1/3 | -48V SIG | APP FIG. 6 | A22 |
| G | 1-1/3 | -48V SIG | APP FIG. 2 | D11 |
| N | 1-1/3 | -48V SIG | APP FIG. 2 | D21 |
| J | 1-1/3 | -48V SIG | APP FIG. 2 | D12 |
| K | 1-1/3 | -48V SIG | APP FIG. 3 | E11 |
| L | 1-1/3 | -48V SIG | APP FIGS. 18,19 | G11 |
| M | 1-1/3 | -48V SIG | APP FIGS. 12,13 | J11 |
| N | 1-1/3 | -48V SIG | APP FIGS. 14,15, 17,22,23,24 | P11,L13 N66,R16 |
| P* | 1-1/3 | -48V SIG | APP FIG. 16 | A32 |
| Q | 1-1/3 | -48V SIG | APP FIGS.7,8,9, 10,11 | (R) M24 (N) H31 (T) S11 |
| A | | GRD | APP FIG. 1 | A16 |
| B | | GRD | APP FIG. 1 | A26 |
| C | | GRD | APP FIG. 1 | A36 |
| D | | GRD | APP FIG. 1 | A46 |
| E | | GRD | APP FIG. 1 | A17 |
| F | | GRD | APP FIG. 1 | A27 |
| G | | GRD | APP FIGS.1,2,3,21 | A37,D14 E22 |
| M | | GRD | APP FIG. 3 | E32 |
| J | | GRD | APP FIG. 3 | EN2 |
| K | | GRD | APP FIG. 3 | E52 |
| L | | GRD | APP FIGS. 6,18,19 | AN7,G15 |
| M | | GRD | APP FIGS. N,12,13 | N18,J28 |
| N | | GRD | APP FIGS. 14,15, 17,22,23,24 | P22,L11 N68,R38 |
| P* | | GRD | APP FIG. 16 | A28 |
| Q* | | GRD | APP FIG. 16 | A38 |
| R | | GRD | APP FIGS. 7,8,9, 10,11 | (R) N15 (N) N38 (T) S18 |

*(P) FUSE AND (P) AND (Q) GROUNDS SERVE APP FIG. 16 LOCATED ON THE MEMORY RELAY FRAME

| BATTERY SYMBOL | VOLTAGE RANGE |
|---|---|
| -N8 | 45-50V |
| +130 | 125-135V |
| -130 | 125-135V |

Fig. 10 – Fusing Note

102.

| FEATURE OR OPTION | | | | PROVIDE APP FIG. | PROVIDE APP OR WIR | QUANTITY |
|---|---|---|---|---|---|---|
| REGISTER CONTROL RELAYS | | | | 1 | | 1 PER REG |
| DIAL PULSE COUNTING | | | | 2 | | 1 PER REG |
| DIAL PULSE REGISTER | FOR 4 DIGITS | | | 3 | ZM | 1 PER REG |
| | FOR 5 DIGITS | | | | ZE,ZN | |
| | FOR 6 DIGITS | | | | ZE,ZF,ZO | |
| | FOR 7 DIGITS | | | | ZE,ZF,ZG, ZP | |
| | FOR 8 DIGITS | | | | ZE,ZF,ZG, ZH,ZQ | |
| | FOR 9 DIGITS | | | | ZE,ZF,ZG, ZH,ZJ,ZR | |
| | FOR 10 DIGITS | | | | ZE,ZF,ZG, ZH,ZJ,ZK, ZS | |
| | FOR 11 DIGITS | | | | ZE,ZF,ZG, ZH,ZJ,ZK, ZL | |
| REGISTER TIMING | | | | N | | 1 PER REG |
| REGISTER AWAITS AN ADDITIONAL DIGIT (FOR EXAMPLE: A STATION DIGIT ) | REQ | | | 5 | | 1 PER REG |
| | NOT REQUIRED | | | | Q | |
| MARKER SELECTION | | | | 6 | | 1 PER REG |
| LINE LOCATION & CLASS RELAYS | | | | 16 | | 1 PER REG |
| WHEN MORE THAN 10 CLASSES OF SERVICE ARE REQUIRED | | | | | Z | |
| WHEN 10 OR LESS CLASSES OF SERVICE ARE REQUIRED | | | | | Y | |
| AMA OPERATION REQUIRED | | | | | W | |
| COIN FEATURE REQUIRED REGISTER SERVES | DIAL TONE FIRST LOOP START COIN LINES | | | 7,10 11 | M | 1 PER REG |
| | DIAL TONE FIRST LOOP START COIN LINES AND COIN FIRST GROUND START COIN LINES | | | 7,10 11 | V,W | 1 PER REG |
| | COIN FIRST | LOOP START COIN LINES | | 9,11 | J | 1 PER REG |
| | | GROUND START COIN LINES | REG RETURNS DEPOSIT ON PERM SIGS ABANDONED CALLS,CALLS TO OPERATOR TRKS. AND OTHER FREE TRKS. ON TRK. LK FRAME | 11 | M,J,V, ZD | 1 PER REG |
| | | | REG RETURNS DEPOSIT ON PERM SIGS AND ABANDONED CALLS | 8 | M,J | 1 PER REG |
| | WHERE COIN RETURN POT.IS | NEGATIVE | | | G | |
| | | POSITIVE | | | F | |
| COIN FEATURE NOT REQUIRED | | | | | J,K | |
| 2 PARTY TEST | REQ WHEN NO TIP PARTY STATION GROUND IS GREATER THAN 1000 Ω ± 10% | | | 12 | | 1 PER REG |
| | REQ WHEN ANY TIP PARTY STATION IS GREATER THAN 1100Ω | | | 13 | | |
| | NOT REQUIRED | | | | X | |
| PREFIX COUNTER | REQ FOR 11X SERVICE CODES | | | 18 | ZA | 1 PER REG |
| | REQ FOR 11 FOREIGN AREA DIRECTING CODES & PRETRANSLATOR DOES NOT TRANSLATE 11 CODES | | | | | |
| | REQ FOR 11 FOREIGN AREA DIRECTING CODES & PRETRANSLATOR TRANSLATES 11 CODES | | | | ZB | |
| | NOT REQUIRED | | | | ZC | |
| WHERE PRETRANSLATION IS IN THE REG CKT | FOR "A" DIGIT | | | 14 | | 1 PER REG |
| | FOR "B" DIGIT | | | 15 | | 1 PER REG |
| | WHERE "A" DIGIT OF 11 PREFIX AREA CODES IS TRANSLATED DIFFERENTLY THAN THE "A" DIGIT OF HOME AREAS CODES | | | | D | |

Fig. 11 – Feature or Option Note

103.

| NETWORK VALUES | | |
|---|---|---|
| NETWORK NO. | RESISTANCE IN OHMS | CAPACITANCE IN UF |
| 1 | 470 | 0.11 |
| 2 | 120 | 0.3 |
| 3 | 150 | 0.4 |
| 4 | 150 | 1.0 |

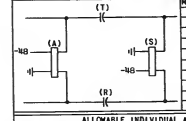
Fig. 12 – Network Values Note

104.

| RECORD OF APP FIGURES, WIRING AND APPARATUS CHANGES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CHANGED ON ISS | IF JOB RECORDS DO NOT SPECIFY | THIS OPTION WAS FURN | SEE NOTE | USE IN CIRCUIT | | | | |
| | | | | STD | A & M | | M D | |
| 2D | S OR T | T | 102 | S | | | T | |
| 2D | A OR B | B | | A | | | B | |
| 2D | E | NONE | 102 | E | | | | |

Fig. 13 – Job Record Note

| TRANSMISSION TEST REQUIREMENTS (1000 CYCLE LOSS BETWEEN 500Ω LINES) | |
|---|---|
| | MAX ALLOWABLE CIRCUIT LOSS (db) |
| | 0.4 |




| ALLOWABLE INDIVIDUAL APPARATUS LOSSES (db) | | | | | |
|---|---|---|---|---|---|
| APPARATUS | DESIG | CODE | MAX LOSS | MIN LOSS | REMARKS |
| CAPACITORS | T,R | 2 μF | 14.5 | 11.5 | SEE NOTE 1 |
| RELAY | A | AJ8 | 0.2 | | |
| RELAY | S | AJ1 | 0.2 | | |

NOTES:
1. THE IND LOSS FOR THE (T) & (R) CAPACITORS SHALL BE WITHIN 0.5db OF EACH OTHER

Fig. 14 – Transmission Test Requirements Table

| WORKING LIMITS | |
|---|---|
| MAX EXT CKT LOOP RES | 1650 |
| MIN INS RES | 10,000 |
| MAX-EARTH POT. | ±10V |

Fig. 15 – Working Limits Table

Fig. 10, 11, 12, 13, 14 and 15

## NOTES

1. THE PURPOSE OF A SEQUENCE CHART IS PRINCIPALLY TO SERVE AS A GUIDE TO THE UNDERSTANDING OF THE CIRCUIT AS A WHOLE AND AS A KEY TO THE ORDER OF EVENTS IN THE OPERATION OF THE CIRCUIT. FOR THIS PURPOSE, A SEQUENCE CHART MAY NOT NECESSARILY DEPICT ALL OF THE INTERACTIONS TAKING PLACE IN THE CIRCUIT. THE SEQUENCE CHART SUPPLEMENTS, BUT DOES NOT REPLACE, THE WRITTEN CIRCUIT DESCRIPTION (CD) WHICH ALWAYS ACCOMPANIES A SWITCHING SYSTEMS SD DRAWING.

2. SEQUENCE CHARTS EMPLOY SYMBOLS TO SHOW THE OPERATION AND RELEASE OF THE RELAYS, SWITCHES, AND OTHER DEVICES AS THEY PERFORM THEIR VARIOUS FUNCTIONS IN THE CIRCUIT.

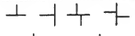
3. TIME PROGRESSES FROM TOP DOWN, AND NEVER IN AN UPWARD DIRECTION, NOR AROUND AN ACUTE ANGLE.

4. THE OPERATION AND RELEASE OF THE CIRCUIT COMPONENTS IS INDICATED BY SYMBOLS PLACED IN A VERTICAL LINE(S) WHICH SERVES TO TRACE THE COURSE OF THE CIRCUIT ACTION. A SINGLE LINE OF ACTION MAY BRANCH INTO TWO OR MORE DEPENDENT LINES OF ACTION, AND CONVERSELY, SEVERAL LINES OF ACTION MAY CONVERGE. THUS, CAUSES ARE LINKED WITH THEIR EFFECTS BY SYMBOLS PLACED TO PORTRAY IN A CONCISE MANNER THE PROGRESSION OF THE CIRCUIT ACTION.

5. EACH OPERATE AND RELEASE SYMBOL IS IDENTIFIED BY THE FUNCTIONAL DESIGNATION OF THE APPARATUS IT REPRESENTS. IF THE APPARATUS IS IN ANOTHER CIRCUIT, BUT IS INCLUDED IN THE SEQUENCE CHART TO AID UNDERSTANDING, AN ABBREVIATED TITLE OF THE OTHER CIRCUIT IS GIVEN IN PARENTHESIS FOLLOWING THE FUNCTIONAL DESIGNATION, i.e., A (MKR), B (T), ETC.

6. COORDINATES ARE USED TO LOCATE THE POSITION OF THE SYMBOLS. NUMBERS STARTING WITH 1, EVENLY SPACED, ARE PLACED FROM TOP TO BOTTOM ON THE LEFT AND RIGHT-HAND EDGES OF THE SHEET. LETTERS ARE PLACED LEFT TO RIGHT AT THE TOP AND BOTTOM EDGES OF THE SHEET. THUS, COORDINATE G24 MEANS VERTICAL COLUMN G, HORIZONTAL LINE 24.

7. HORIZONTAL AND VERTICAL LINE COMBINATIONS ARE USED AS FOLLOWS:



CONNECTION BETWEEN LINES

NO CONNECTION BETWEEN LINES

8. CONTROLLED DIRECTION IS INDICATED BY LINE COMBINATIONS USED AS FOLLOWS:

ACTION ON VERTICAL LINE AFFECTS ACTION TO LEFT BUT NOT TO RIGHT.

NO CONNECTION BETWEEN ACTION ON LEFT AND RIGHT HORIZONTAL LINES. THE ACTION ON THE TOP VERTICAL LINE HAS NO CONNECTION WITH THE ACTION ON THE LEFT HORIZONTAL LINE.

9. MAJOR ASSUMPTIONS OR OPTIONS ON WHICH A SEQUENCE CHART IS BASED ARE STATED IN THE SC TITLE, OR AS A SHEET NOTE ON THE SAME SHEET.

10. NOTATIONS ARE USED IN CONJUNCTION WITH FUNCTIONAL DESIGNATIONS TO GIVE ESSENTIAL INFORMATION; THESE ARE EXPLAINED IN THE NEXT COLUMN UNDER THE HEADING "DESIGNATIONS".

## DESIGNATIONS

| FOR RELAYS | EXPLANATION |
|---|---|
| 1. C- | ONE OR MORE OF CO TO $C_n$ OR CA TO $C_n$ |
| 2. CO-9 | ALL OF CO TO C9 INCLUSIVE |
| 3. CO-Cn | ALL OF CO TO $C_n$ INCLUSIVE |
| 4. CO(0-9) | ALL OF C00 TO C09 INCLUSIVE |
| 5. C(0-9)A | ALL OF C0A TO C9A INCLUSIVE |
| 6. FA-D | ALL OF FA TO FD INCLUSIVE |
| 7. A,C | BOTH A AND C |
| 8. HG $\frac{2}{5}$ | A COMBINATION OF *2 OUT OF 5* OF HG |
| 9. RF $\frac{1}{2-8}$ | ANY ONE OF A SERIES RF2 TO RF8 |
| 10. L/R | EITHER L OR R |
| 11. (TOP) MC | TOP HALF OF MC MULTICONTACT RELAY |
| 12. (BOT) MC | BOTTOM HALF OF MC MULTICONTACT RELAY |
| 13. MC | BOTH HALVES OF MC MULTICONTACT RELAY |

| FOR OTHER APPARATUS | EXPLANATION |
|---|---|
| 14. A JACK | A JACK CONTACT |
| 15. AR KEY | AR KEY CONTACT |
| 16. AL LAMP | AL LAMP |
| 17. T HOLD | T HOLD MAGNET |
| 18. J SEL | J SELECT MAGNET |
| 19. PAC MAG | PAC MAGNET |
| 20. A2 PERF | A2 PERFORATOR MAGNET |
| 21. RDR PIN | READER PIN |
| 22. (PU) TC INT | TC INTERRUPTER, PU CONTACT |
| 23. RC SEL 10-11 | RC SELECTOR STEPS FROM POSITION 10 TO POSITION 11 |
| 24. AD XSTR | AD TRANSISTOR |
| 25. CL PH XSTR | CL PHOTO TRANSISTOR |
| 26. TWA TUBE | TWA TUBE |
| 27. VAR VARISTOR | VAR VARISTOR |

| SYMBOL | EXPLANATION |
|---|---|
| 1. A | A RELAY OPERATES |
| 2. AL LAMP | AL LAMP LIGHTS |
| 3. TW TUBE | TW TUBE OUTPUT CURRENT INCREASES |
| 4. A | A RELAY RELEASES |
| 5. AL LAMP | AL LAMP EXTINGUISHES |
| 6. TW TUBE | TW TUBE OUTPUT CURRENT DECREASES |
| 7. A, B, C, D | SIMPLE SEQUENTIAL CAUSE AND EFFECT RELATION. RELAY A OPERATES AND CAUSES THE OPERATION OF RELAY B WHICH, IN TURN, CAUSES THE OPERATION OF RELAY C. RELAY C THEN RELEASES RELAY D. |
| 8. A, B, C, D | MULTIPLE EFFECTS FROM A SINGLE CAUSE. RELAY A OPERATES AND CAUSES THE OPERATION OF BOTH RELAYS B AND C AND THE RELEASE OF RELAY D. |
| 9. A, B, C | MULTIPLE CAUSES FOR A SINGLE EFFECT. BOTH RELAYS A AND B MUST OPERATE BEFORE RELAY C OPERATES. |
| 10. A, B, C, D, E | MULTIPLE CAUSES WITH MULTIPLE EFFECTS. BOTH RELAYS A AND B MUST OPERATE BEFORE EITHER OF RELAYS C AND D CAN OPERATE. THE ARROW IS USED TO INDICATE ONE WAY ACTION. IN THIS ILLUSTRATION E OPERATES FROM B ONLY. |
| 11. A, B, C | ALTERNATIVE CAUSES. EITHER OF RELAYS A AND B WILL CAUSE OPERATION OF RELAY C. |
| 12. Z | Z RELAY OR OTHER APPARATUS HAS EITHER OPERATED OR RELEASED. |
| 13. A, SR, CW, 2 SEC, TMA TUBE | TIME DELAY<br>THE SR RELAY IS SLOW TO RELEASE FOLLOWING THE OPERATION OF RELAY A.<br>THE TWA TUBE OPERATES 2 SECONDS AFTER CW RELAY OPERATES. |
| 14. A, B | DOTTED VERTICAL LINE MAY INDICATE ONE OF FOLLOWING:<br>A) INDEFINITE TIME INTERVAL.<br>B) INTERMEDIATE ACTION WHICH IS EITHER ASSUMED OR SHOWN ELSEWHERE. IN THE LATTER CASE, REFERENCE IS USUALLY MADE TO THE PLACE WHERE THE ACTION IS SHOWN. |

## SYMBOLS

| SYMBOL | EXPLANATION |
|---|---|
| 15. BTI, TRK IDLE, TRK BUSY, BT, PB | ALTERNATIVE ACTION. THE OPERATION OF THE BTI RELAY CAUSES THE RELEASE OF EITHER THE BT OR PB RELAY DEPENDING UPON WHETHER THE TRUNK IDLE OR TRUNK BUSY CONDITION IS MET. |
| 16. A B C D E, 1, 2, 3, 4, HG, LCK, LCK HG, TK | TK RELAY HAS OPERATED ON LINE 4 AS THE RESULT OF THE OPERATION OF BOTH HG ON LINE 1 AND LCK ON LINE 3. NEITHER HG NOR LCK OPERATION ALONE IS SUFFICIENT TO OPERATE TK. THE DIAGONAL LINE MAY BE CONTINUOUS OR AS SHOWN. HG AND LCK AT THE ENDS OF THE DIAGONAL LINE REFER TO THE FUNCTIONAL DESIGNATION OF THE APPARATUS TO BE ASSOCIATED. WHERE THIS APPARATUS IS SHOWN IN DIFFERENT SCs, ON DIFFERENT SHEETS OF THE DRAWING, OR IN WIDELY SEPARATED AREAS ON THE SAME SHEET, THE COORDINATE LOCATION OF THE ENDS OF THE DIAGONAL LINE MAY BE ADDED TO THE FUNCTIONAL DESIGNATION. |
| 17. RV(1R), TG, OF, SP | TG RELAY RELEASES AND THEN REOPERATES ON CURRENT REVERSAL. |
| 18. | TROUBLE RECORD<br>THE SPAN OF CIRCUIT OPERATION DURING WHICH A PARTICULAR TROUBLE MAY BE EXPECTED IF A TROUBLE RECORD IS TAKEN IS INDICATED BY TRIANGULAR MARKS AT THE BEGINNING AND END OF THE SPAN.<br>A SOLID INVERTED TRIANGLE (▼) INDICATES THAT A PERFORATION IS MADE, A LAMP IS LIGHTED, OR A NOTATION IS MADE ON A TICKET IF A TROUBLE RECORD IS TAKEN AT OR AFTER THIS TIME.<br>A SOLID UPRIGHT TRIANGLE (▲) INDICATES THAT A PERFORATION IS NOT MADE, A LAMP IS NOT LIGHTED, OR A NOTATION IS NOT MADE ON A TICKET IF A TROUBLE RECORD IS TAKEN AT OR AFTER THIS TIME. |
| RK ▼, RK ▲ | THIS INDICATES THAT RK PERFORATION IS MADE OR RK LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN WHILE THE RK RELAY IS OPERATED. |
| IS ▼(6-1) | THIS INDICATES THAT CHARACTER 1 IS PRINTED IN POSITION 6 ON A TROUBLE TICKET. |
| C, A2/5-F2/5 ▼ A2/5-F2/5 (3 TO 8) | IN THIS CASE, ONLY THE TICKET POSITION NUMBERS, 3 TO 8, ARE GIVEN. THE CHARACTERS THAT ARE PRINTED IN THESE POSITIONS ARE NOT SHOWN SINCE ANY CHARACTER FROM 0 TO 9, A DASH, OR AN ASTERISK MAY BE PRINTED. |
| PR2, LC ▼ TI, PR2, LC ▲ TI | THIS INDICATES THAT TI PERFORATION IS MADE OR TI LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN WHILE THE PR2 RELAY IS OPERATED. |

| SYMBOL | EXPLANATION |
|---|---|
| 18. (CONT) AC ▼, RD, CO ▲ AC | THIS INDICATES THAT AC PERFORATION IS MADE OR AC LAMP IS LIGHTED IF A TROUBLE RECORD IS TAKEN AFTER THE AC RELAY HAS OPERATED AND BEFORE THE RD RELAY HAS OPERATED. |
| CKG ▼(1-0), BC, RK ▼(1-1), DP (TG), TCK ▼(1-2) | THIS INDICATES THAT ONE OF A NUMBER OF TROUBLE INDICATIONS ARE MADE TO INDICATE CIRCUIT OPERATION PROGRESS. IF THE CIRCUIT OPERATION HAS ADVANCED TO THE OPERATION OF THE CKG RELAY, CHARACTER 0 IS PRINTED IN TROUBLE TICKET POSITION 11. IF THE CIRCUIT OPERATION HAS ADVANCED TO THE OPERATION OF THE RK RELAY, CHARACTER 1 IS PRINTED IN POSITION 11. CHARACTER 2 IS PRINTED IN POSITION 11 IF THE TCK RELAY IS OPERATED. IT IS NOT NECESSARY TO SHOW UPRIGHT TRIANGLES (▲) INDICATING THE END OF THE PRINTING OF A CHARACTER SINCE ONLY ONE CHARACTER AT A TIME CAN BE PRINTED IN A POSITION ON A TICKET. |

Fig. 16 – Sequence Charts – Methods of Showing Information

## SEQUENCE CHART INDEX

| DESIG | OPR | RLS |
|---|---|---|
| DP DRG REG CKT | | |
| 11A | 1W9 | 3Z12 |
| 11B | 1X11 | 3Z12 |
| 11C | 1W19 | 3Z12 |
| 2P | 6H12 | 6N33 |
| A2/5 | 3F36<br>1N08 | 3Z12<br>6U33<br>7F35<br>10P15 |
| AS | 3G7<br>6K12<br>8F11<br>9F10 | |
| B2/5 | 1N07 | 3Z12 |
| BS | 3E37<br>4A10<br>4Z36<br>1NC9 | |
| BT | G89 | 6A23 |
| C2/5 | 1N06 | 3Z12 |
| C1 | 9R1D<br>9R19<br>10D11<br>11G13<br>11G21<br>11N18<br>11N25<br>13P21<br>13P28 | 9R15<br>9U25<br>10D15<br>11G17<br>11G27<br>11N22<br>11N32<br>13P25 |
| CLR | 9E17 | 9D26 |
| CM3 | 1N722 | |
| CMA | 1N022 | |
| CMB | 1N022 | |
| CMC | 1N022 | |
| CN | 8B11 | 8C36 |
| CN1 | 9B11<br>9V3<br>11B5 | 8N21<br>10H22<br>11C23<br>13P30 |
| CNT | 13H8<br>13S5 | 13E15<br>13P39 |
| CNT1 | 9D11 | 9C24 |
| CNT2 | 9E18 | 8D28 |
| CNT3 | 13U9 | 13P4 |

| DESIG | OPR | RLS |
|---|---|---|
| CR | 8D6<br>8V9 | 8N14<br>8V20 |
| CR1 | 8Q1D<br>8V16 | 8N15<br>8T21 |
| CR1<br>TUBE | 8D6<br>8V15 | 8R11<br>8U17 |
| TPT | 6K20<br>5S14 | 6M22<br>6Q15 |
| TPT<br>TUBE | 6K19<br>6S13 | 5M22<br>6Q15 |
| VF2/5 | 3B4<br>4B22<br>6J9<br>7A8<br>8E7<br>9F7 | |
| VG2/5 | 3B4<br>4B22<br>6J9<br>7A8<br>8E7<br>9F7 | |

| DESIG | OPR | RLS |
|---|---|---|
| MARKER CKT | | |
| 2P | 6G12<br>7F11 | |
| LME | | 3Y1<br>6S23<br>7N25<br>8D26 |
| CN | 8B6 | |
| CS | 4W20<br>6G1D<br>7F9<br>8A10<br>9B8 | |
| DCT1 | 3E11<br>4E29<br>6J15<br>7A14<br>8D14<br>9E14 | |
| DIS1 | 3Y5<br>6S26<br>7N28<br>8D28<br>10S7 | |
| DIS2 | 3Y5<br>6S26<br>7N28<br>8D29<br>10S7 | |
| GTL1 | 4W20<br>6G10<br>7F9<br>8A10<br>9B8 | |
| MAN | 4W21 | |
| RBT | 6B5 | |
| TR2 | 6C5 | |
| TRL | 6B7 | |
| TRLA | 6B8 | |
| TSE1 | | 3E1<br>6A5<br>7B6<br>8D3<br>9E3 |

| DESIG | OPR | RLS |
|---|---|---|
| MARKER CONN CKT | | |
| MA | 3N35 | 3Z8 |
| MB | 3N36 | 3Z9 |
| MC | 3M35 | 3AA8 |
| MD | 3M36 | 3AA9 |
| ME | 3L35 | 3AB8 |
| MS | 3N34<br>6S17<br>7N21 | 3AA7<br>6Q28<br>7N30<br>8B31 |
| RA | 3F32 | 3W8 |
| RB | 3F33 | 3W8 |
| RC | 3Q32 | 3W8 |
| RD | 3N33 | 3W8 |
| RE | 3M33 | 3W8 |
| RS | 3P29<br>6S7<br>7N21 | 3W7<br>6Q28<br>7N30<br>8B31 |
| TM | 3N29 | |
| TRK LINK & CONN CKT | | |
| FA2 | 3E3<br>4E21<br>6K7<br>7B7<br>8D5<br>9E6 | 3E13<br>4E31<br>6J17<br>7D16<br>8D16<br>9E16 |
| LV2 | 3E4<br>4E22<br>6K9<br>7B8<br>8D6<br>9E7 | 3G1N<br>4G32<br>6G18<br>7F17<br>8B17<br>9D17 |
| INTERRUPTER CKT | | |
| ST | 6A10 | 6A24 |
| GROUP BUSY CKT | | |
| RB1 | 1NAB5 | |
| RB2 | 1NAB6 | 1NZ15 |
| RB3-6 | 1NAB7 | 1NZ16 |
| RT | 1NZ1N | |

| DESIG | OPR | RLS |
|---|---|---|
| PRETRANSLATOR CKT | | |
| GS | 1NW19 | |
| HDK | 1NU21 | |
| PRA | 1NU1G | |
| PRS | 1NU18 | |
| TM | 1NS18 | |

**Fig. 17 – Sequence Chart Index of Operate and Release Locations**

## CIRCUIT REQUIREMENTS

ORIGINATING REGISTER CIRCUIT - DIAL PULSING (OR)

DRAWING ISSUE 1

| APPARATUS DESIG | APPARATUS CODE | APPARATUS OPTION | FIG. | MECH REST SSP FIG. | MECH REST CONT PRESE TRVL | MECH REST ARM TRVL | CIRCUIT PREPARATION BLOCK OR INSULATE | CIRCUIT PREPARATION TEST CLIP DATA CONN BAT. | CIRCUIT PREPARATION TEST CLIP DATA CONN GRD | TEST SET PREP | TEST SEE NOTE | DIRECT CURRENT FLOW REQT TEST WDG | DIRECT CURRENT FLOW REQT TEST FOR | DIRECT CURRENT FLOW REQT AFTER SOAK MA. | DIRECT CURRENT FLOW REQT TEST MA. | DIRECT CURRENT FLOW REQT READJ MA. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RELAYS | | | | | | | | | | | | | | | | | |
| 11A | AF43 | | 18 | 17 | | | (RA)O | | U(11A) | GRC | | | O | | 31 | 29.5 | |
| M1B | AF27 | | 18 | 210 | | | (RA)G | | U(11B) | GRC | | | O | | 27 | 25.5 | |
| 11C | 1/2 AKE | | 18 | 204 | | | | 2L(11C) | 1L(11C) | B/G | | | O | | 9.2 | 8.7 | MOUNTED WITH (AS) |
| 2P | AF34 | | 13 | 14 | | | (PRL)O | | U(2P) | GRC | | | O | | 27 | 25.5 | |
| A0,1, 2,4,7 | 285A | | 2 | | | | | | | | 1 | | O<br>H<br>R | | 25<br>5<br>1 | | |
| A7 | | | | | | | | | | | | | | | | | |
| AS | 1/2 AKE | | 15 | 204 | | | | 2L(AS) | 1L(AS) | B/G | | | O | | 17 | 16 | MOUNTED WITH (11C) |
| B0,1, 2,4,7 | 285A | | 3 | | | | | | | | 1 | | O<br>H<br>R | | 25<br>5<br>1 | | |
| BT | AF80 | | 6 | 242 | | | | | U(BT) | GRC | | | O | | 62.5 | 52 | |
| C0,1, 2,4,7 | 285A | | 3 | | | | | | | | 1 | | C<br>H<br>R | | 25<br>5<br>1 | | |
| CI | AF52 | | 11 | 218 | | | | | U(CI) | GRD | 2 | | C | | 7.1 | 6.7 | |
| CLR | 28CBB | | 8 | A | | | (CNT)O<br>2(CNT1) | 6(CNT1)<br>6(CNT1)<br>5(CNT1) | B(CNT1)<br>B(CNT1)<br>PCH M15 | NGB<br>NGB<br>NGB | 3<br>3 | P/S<br>P/S<br>S | O<br>NC<br>O | -12<br>-12 | 0.5<br>C.C.<br>1.4 | 0.3<br>0.2 | |
| | | | | | | | (LT)O | 2(CR) | L(CR1) | NGB | | P | O | | 1.6 | | |
| TUBES, ELECTRON | | | | | | | | | | | | | | | | | |
| CR1 | | | 8,11 | | | | | | | | | | | | | | SEE BSP |
| CR2 | | | 8,11 | | | | | | | | | | | | | | SEE BSP |
| CT | | | 7 | | | | | | | | | | | | | | SEE BSP |
| TPT | | | 12 | | | | | | | | | | | | | | SEE BSP |

TEST NOTES:

1. CONNECT GROUND TO TERMINAL OF RELAY UNDER TEST (1,4,8,9,10 FOR -0,-1,-2,-4,-7 RESPECTIVELY).
   PROCEDURE FOR TESTING DRY REED RELAYS USED FOR REGISTERING DIGITS.
   PREPARATION:
   CONNECT DIRECT BATTERY TO TERMINAL L2 OF TEST SET.
   PLACE L KEY IN NEUTRAL POSITION
   CONNECT SLEEVE OF TEST T & R TO LOAD CONTACT (5,7,11,12,13 FOR -0,-1,-2,-4,-7 RESPECTIVELY) OF RELAY UNDER TEST.
   ADJUST REC RHEOSTAT 4 AND THE THREE 4 SWITCHES FOR MINIMUM RESISTANCE.
   CONNECT THE TIP OF THE W4 JACK TO TERMINAL (3) OF THE RELAY UNDER TEST.

| STEP | PROCEDURE | INDICATION | CHECK |
|---|---|---|---|
| A. | CLOSE OPERATE & RELEASE KEYS. | LAMP LIGHTED. | CLOSURE OF LOAD CONTACT. |
| B. | CLOSE HOLD KEY & OPEN OPERATE KEY. | LAMP REMAINS LIGHTED. | HOLD OF LOAC CONTACT. |
| C. | CLOSE 4 KEY & OPEN HOLD & RELEASE KEYS. | LAMP REMAINS LIGHTED. | HOLD OF LOCKING CONTACT. |
| D | CLOSE RELEASE KEY & OPEN 4 KEY. | LAMP EXTINGUISHES. | OPEN OR RELEASE OF LOAD CONTACT. |
| E. | OPERATE VOLTMETER KEY (75V). CLOSE OPERATE KEY. OPEN OPERATE KEY. CLOSE 4 KEY. | FINAL VOLTAGE NOT TO EXCEED 10 VOLTS. | OPEN OR RELEASE OF LOCKING CONTACT (IF VOLTAGE EXCEEDS 10 VOLTS IT INDICATES THAT LOCKING CONTACT DID NOT OPEN). |
| F. | OPEN 4 AND RELEASE KEYS. | | |

2. REMOVE ELECTRON TUBES (CR1) & (CR2), THEN CONNECT DIRECT BATTERY TO L(CI) RELAY.
3. CONNECT 2 & 7 OF (CLR) RELAY WITH A TEMPORARY STRAP.

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Fig. 18 – Circuit Requirements Table

## TIMING REQUIREMENTS

DRAWING ISSUE 1

| APPARATUS DESIG | APPARATUS OPTION | APPARATUS FIG. | CIRCUIT PREPARATION BLOCK OR INSULATE | CIRCUIT PREPARATION TEST CLIP DATA CONN BK. | CIRCUIT PREPARATION TEST CLIP DATA CONN S | CIRCUIT PREPARATION TEST CLIP DATA CONN W | TEST SET PREP STIM KEY | TEST SET PREP REC SW START | TEST SET PREP REC SW STOP | SEE TEST NOTE | TIME REQ MIL-SEC MIN | TIME REQ MIL-SEC MAX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CR1 | | 11 | (CN1)O | GRD | U(CR1) | U(CR2) | MK | 48 | GRD | | 470 | 750 | |
| CR1 | | 8 | | GRD | U(CR) | 4(CR1) | MK | O.C. | GRD | | 500 | 760 | |
| CR2 | | 8 | (CR)O | GRD | U(CN1) | 4(CR1) | MK | GRD | O.C. | | 470 | 750 | |
| CR2 | | 11 | (CN1)O | GRD | U(CR1) | 4(CR2) | MK | 48 | O.C. | | 470 | 750 | |
| CT | | 7 | | | | | | | | 1 | | | |
| DT | | 5 | (RA1)O<br>(MST)NO | GRD | U(DL) | U(MST) | MK | 48 | GRD | | 3000 | 4700 | CONN U(DL) TO U(CN1) |
| TN | | 4 | | | | | | | | 2 | | | |
| TPT | | 12 | | GRD | U(PTA) | 10(2P) | MK | GRD | 48 | * | 229 | 370 | |

TEST NOTES:

1. TO MEASURE THE TIME OF THE (CT) TIMER, OPERATE RELAY (CNT). THE (CNT3) RELAY SHOULD OPERATE IN A MIN OF 10 SECS AND A MAX OF 15 SECS.
2. TO MEASURE THE TIME OF THE (TM) TIMER, OPERATE RELAY (TMA) RELAY (TM) SHOULD OPERATE IN THE INTERVALS INDICATED BELOW.

| (PD) | (CVL) | SEC MIN | SEC MAX |
|---|---|---|---|
| M.O. | M.O. | 20 | 32 |
| M.O. | C | 10 | 15 |
| C | C | 4.8 | 7.2 |

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Fig. 19 – Timing Requirements Table

Fig. 18, 19

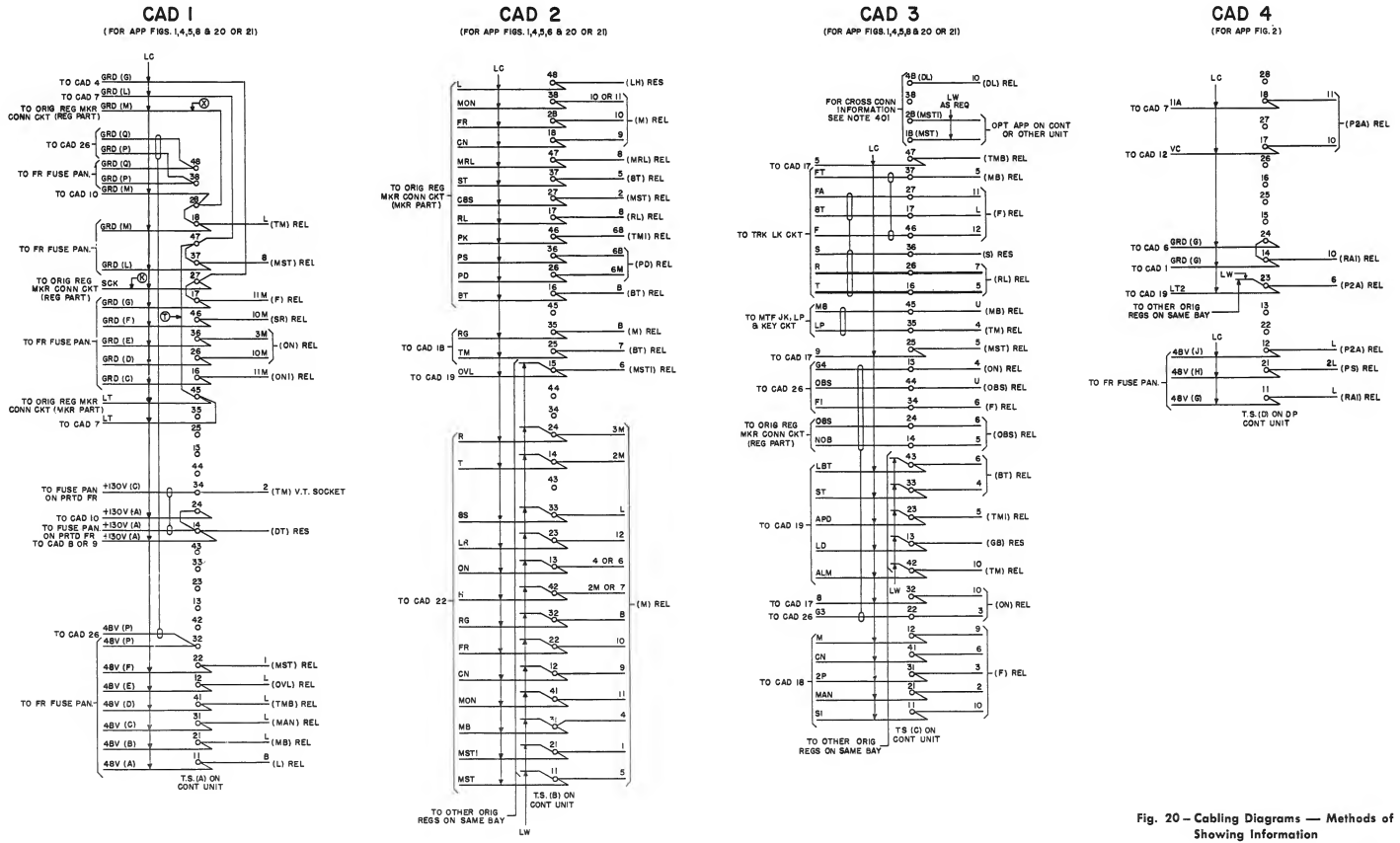
CAD 1
(FOR APP FIGS. 1,4,5,8 & 20 OR 21)
CAD 2
(FOR APP FIGS. 1,4,5,6 & 20 OR 21)
CAD 3
(FOR APP FIGS. 1,4,5,8 & 20 OR 21)
CAD 4
(FOR APP FIG. 2)
LC
TO CAD 4
TO CAD 7
TO ORIG REG MKR CONN CKT (REG PART)
TO CAD 26
TO FR FUSE PAN
TO CAD 10
TO ORIG REG MKR CONN CKT (REG PART)
TO FUSE PAN ON PRTD FR
TO CAD 10
TO CAD 8 OR 9
TO CAD 26
TO FR FUSE PAN
TO ORIG REG MKR CONN CKT (MKR PART)
TO CAD 7
T.S.(A) ON CONT UNIT
TO CAD 18
TO CAD 19
TO CAD 22
TO OTHER ORIG REGS ON SAME BAY
T.S.(B) ON CONT UNIT
FOR CROSS CONN INFORMATION SEE NOTE 401
LW AS REQ
OPT APP ON CONT OR OTHER UNIT
TO CAD 17
TO TRK LK CKT
TO MTF JK, LP & KEY CKT
TO CAD 17
TO CAD 26
TO ORIG REG MKR CONN CKT (REG PART)
TO CAD 19
TO CAD 17
TO CAD 26
TO CAD 18
TO OTHER ORIG REGS ON SAME BAY
T.S.(C) ON CONT UNIT
TO CAD 7
TO CAD 12
TO CAD 6
TO CAD 1
TO CAD 19
TO OTHER ORIG REGS ON SAME BAY
TO FR FUSE PAN
T.S.(D) ON D.P CONT UNIT

**Fig. 20 – Cabling Diagrams — Methods of Showing Information**